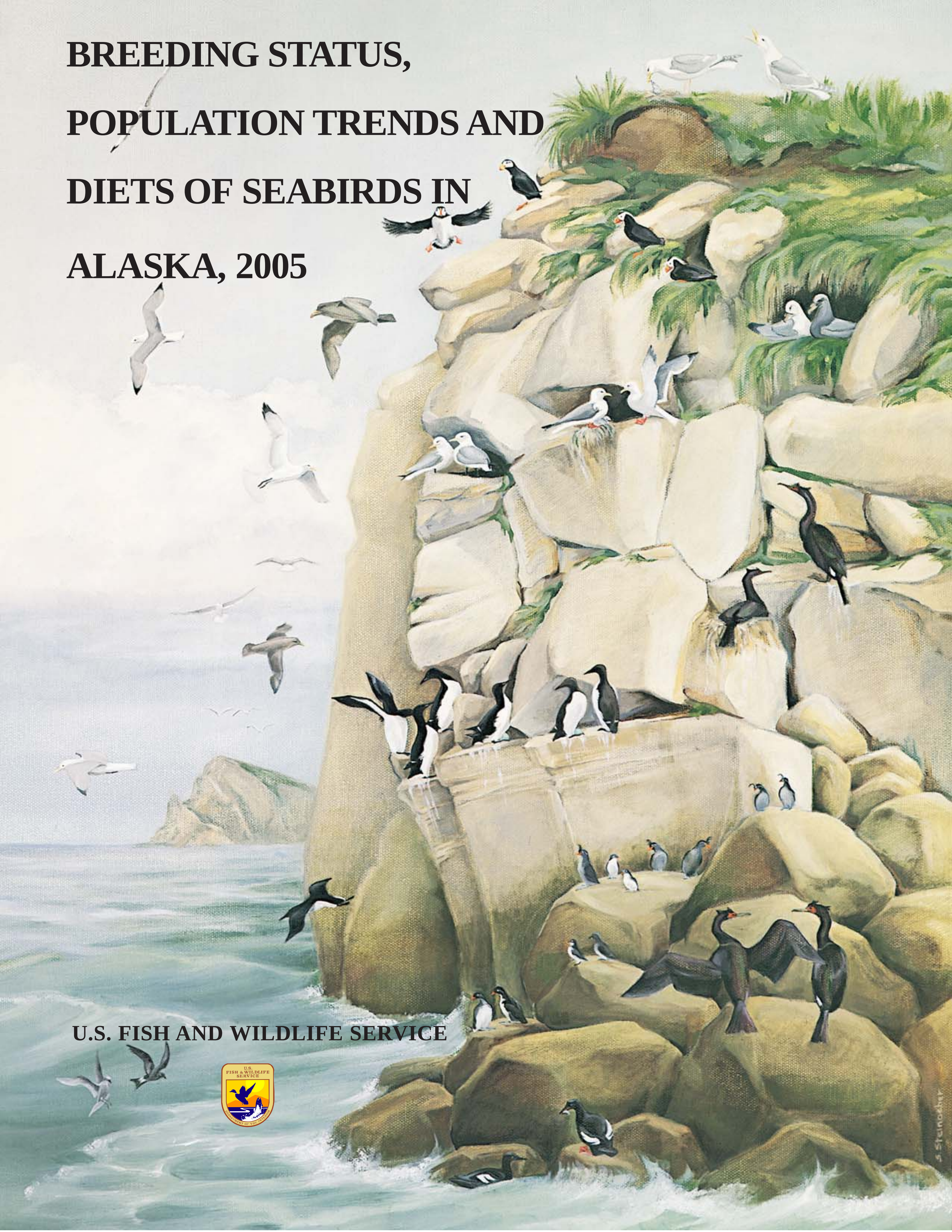
BREEDING STATUS, POPULATION TRENDS AND DIETS OF SEABIRDS IN ALASKA, 2005



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BREEDING STATUS, POPULATION TRENDS AND DIETS OF SEABIRDS IN ALASKA, 2005

Compiled By:

Donald E. Dragoo, G. Vernon Byrd, and David B. Irons[a]

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U.S. Fish and Wildlife Service
Alaska Maritime National Wildlife Refuge
95 Sterling Highway, Suite 1
Homer, Alaska, USA 99603

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[a]Dragoo (don_dragoo@fws.gov) and Byrd (vernon_byrd@fws.gov) at Alaska Maritime NWR, Homer; Irons (david_irons@fws.gov) at U. S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska USA 99503

Executive Summary

Data are being collected annually for selected species of marine birds at breeding colonies on the far-flung Alaska Maritime National Wildlife Refuge (NWR) and at other areas in Alaska to monitor the condition of the marine ecosystem and to evaluate the conservation status of species under the trust of the U. S. Fish and Wildlife Service. The strategy for colony monitoring includes estimating timing of nesting events, rates of reproductive success (e.g., chicks fledged per nest), population trends and diet composition of representative species of various foraging guilds (e.g., offshore diving fish-feeders, offshore surface-feeding fish-feeders, diving plankton-feeders) at geographically dispersed breeding sites. This information enables managers to better understand ecosystem processes and respond appropriately to resource issues. It also provides a basis for researchers to test hypotheses about ecosystem change. The value of the marine bird monitoring program is enhanced by having sufficiently long time-series to describe patterns for these long-lived species. This report is the tenth in a series of annual reports summarizing the results of seabird monitoring efforts at breeding colonies on the Alaska Maritime National Wildlife Refuge (NWR) and elsewhere in Alaska.

In summer 2005 data were gathered on northern fulmars, storm-petrels, cormorants, glaucous-winged gulls, kittiwakes, murres, pigeon guillemots, ancient murrelets, auklets and/or puffins at ten annual monitoring sites on the Alaska Maritime NWR and one annual monitoring site on the Togiak NWR. In addition, data were gathered at other refuge locations which are visited intermittently or were part of a research or monitoring program off refuges.

In 2005, most species exhibited average or earlier than average nesting phenology. Timing of nesting of plankton feeders (storm-petrels and auklets) was normal or early in all cases. Fish feeders (cormorants, gulls, kittiwakes, murres, murrelets, rhinoceros auklets, puffins) were earlier than normal in 10 of 32 cases (species x site), late in 11 cases and about normal in 11 cases. There were four cases where either no eggs hatched (red-legged kittiwakes at St. Paul Island, common and thick-billed murres at Aiktak Island) or where too few hatched to allow comparisons (common murres at Buldir Island).

Plankton feeders had average or above average rates of reproductive success in 13 of 14 cases in 2005, the exception being below average productivity of least auklets at Kasatochi Island. Fish feeders had below average productivity in 30 of 47 cases and average success in 14 instances. Most of the low productivity occurred in cormorants, kittiwakes and murres. All instances of higher than average productivity iin fish feeders occurred in puffins. We found no discernible geographic patterns of reproduction in either plankon or fish feeders.

Storm-petrel populations were increasing at St. Lazaria Island and stable at the remaining two sites. Populations of fish feeders (northern fulmars, cormorants, gulls, kittiwakes, murres, guillemots, rhinoceros auklets, puffins) exhibited stable populations in 37 of 67 cases. We found significant upward trends in 12 cases and significant declines in 18 cases. No geographic patterns were apparent with regard to population trends of Alaskan seabirds.

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

List of Tables

List of Tables (continued)

List of Tables (continued)

List of Figures

List of Figures (continued)

List of Figures (continued)

Introduction

This report is the tenth in a series of annual reports summarizing the results of seabird monitoring efforts at breeding colonies on the Alaska Maritime National Wildlife Refuge (NWR) and elsewhere in Alaska (see Byrd and Dragoo 1997, Byrd et al. 1998 and 1999, Dragoo et al. 2000, 2001, 2003, 2004, 2006 and 2007 for compilations of previous years' data). The seabird monitoring program in Alaska is designed to keep track of selected species of marine birds that indicate changes in the ocean environment. Furthermore, the U. S. Fish and Wildlife Service has the responsibility to conserve seabirds, and monitoring data are used to identify conservation problems. The objective is to provide long-term, time-series data from which biologically-significant changes may be detected and from which hypotheses about causes of changes may be tested.

The Alaska Maritime NWR was established specifically "To conserve marine bird populations and habitats in their natural diversity and the marine resources upon which they rely" and to "provide for an international program for research on marine resources" (Alaska National Interests Land Conservation Act of 1982). The monitoring program is an integral part of the management of this refuge, by providing data that can be used to define "normal" variability in demographic parameters and identify patterns that fall outside norms and thereby constitute potential conservation issues. Although approximately 80% of the seabird nesting colonies in Alaska occur on the Alaska Maritime NWR, marine bird nesting colonies occur on other public lands (e.g., national and state refuges) and on private lands as well.

The strategy for colony monitoring includes estimating timing of nesting events, reproductive success, population trends and prey used by representative species of various foraging guilds (e.g., murres are offshore diving fish-feeders, kittiwakes are offshore surface-feeding fish-feeders, auklets are diving plankton-feeders, etc.) at geographically dispersed breeding sites along the entire coastline of Alaska (Fig. 1). A total of 10 sites on the Alaska Maritime NWR, located roughly 300-500 km apart, are scheduled for annual surveys (Byrd 2007), and at least some data were available from most of these in 2005. Furthermore, data are recorded annually or semiannually at other sites in Alaska (e.g., Cape Peirce, Togiak NWR). In addition, colonies near the annual sites are identified for less frequent surveys to "calibrate" the information at the annual sites. Data provided from other research projects (e.g., those associated with evaluating the impacts of invasive rodents on marine birds) also supplement the monitoring database.

In this report, we summarize information from 2005 for each species; i.e., tables with estimates of average hatch dates and reproductive success, and maps with symbols indicating the relative timing of hatching and success at various sites. In addition, historical patterns of hatching chronology and productivity are illustrated for those sites for which we have adequate information. Population trend information is included for sites where adequate data have been gathered. Seabird diet data from several locations are presented as well.

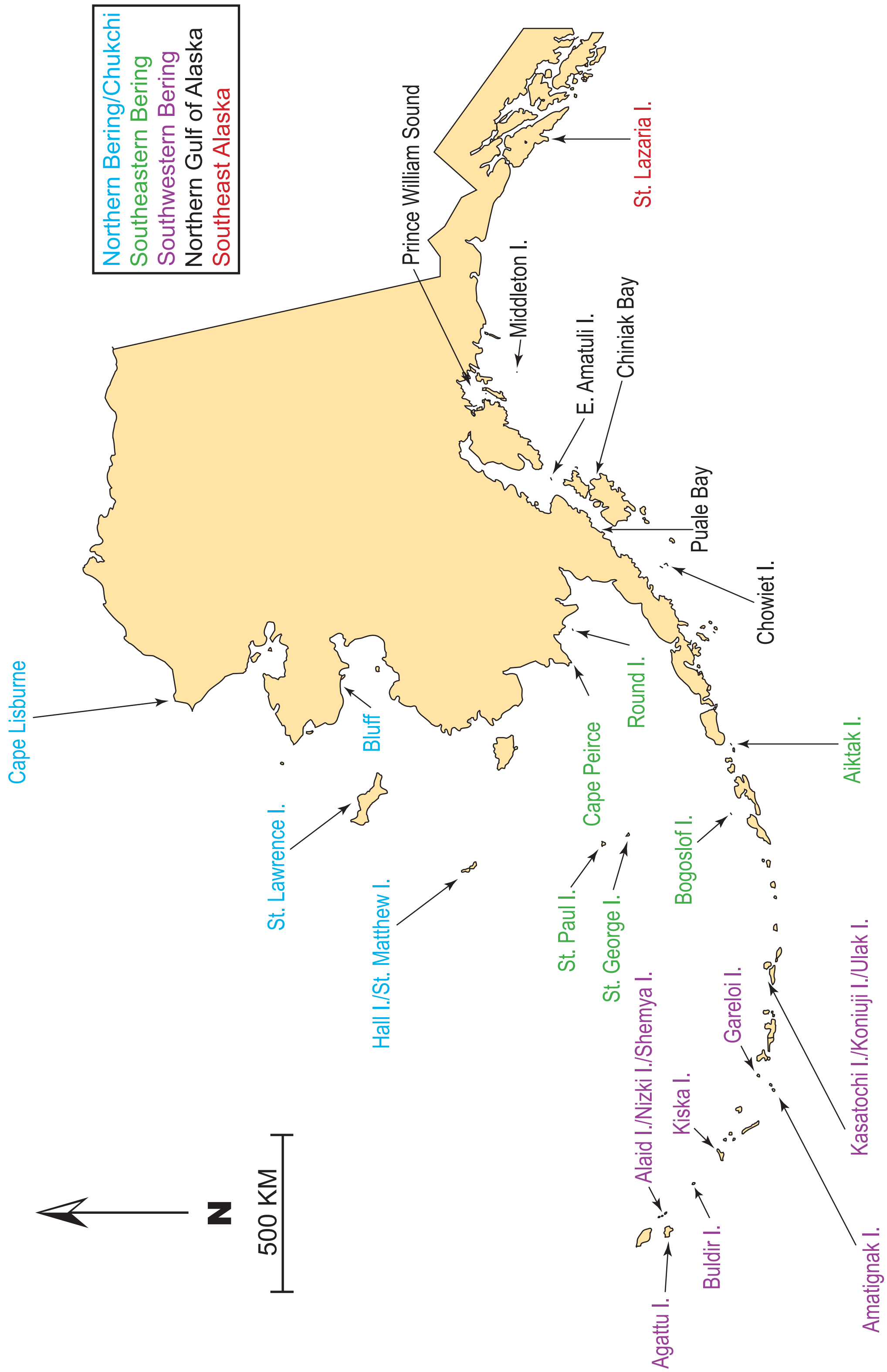


Figure 1. Map of Alaska showing the locations of seabird monitoring sites summarized in this report. Text colors indicate geographic regions.

Methods

Data collection methods generally followed protocols specified in "Standard Operating Procedures for Population Inventories" (USFWS 2000*a*, *b*, *c*). Timing of nesting events and productivity usually were based on periodic checks of samples of nests (frequently in plots) throughout the breeding season, but a few estimates of productivity were based on single visits to colonies late in the breeding season (as noted in tables). Hatch dates were used to describe nesting chronology. Productivity typically was expressed as chicks fledged per egg, but occasionally other variables were used (Table 1). Population surveys were conducted for ledge-nesting species at times of the day and breeding season when variability in attendance was reduced. Most burrow-nester counts were made early in the season before vegetation obscured burrow entrances. Deviations from standard methods are indicated in reports from individual sites which are appropriately referenced.

Table 1. Productivity parameters used in this report.

Species	Productivity Value
Storm-petrels	Chicks Fledged/Egg (Total chicks fledged/Total eggs)
Cormorants	Chicks Fledged/Nest (Total chicks fledged/Total nests)
Glaucous-winged gull	Hatching Success (Total chicks/Total eggs)
Kittiwakes	Chicks Fledged/Nest (Total chicks fledged/Total nests)
Murres	Chicks Fledged/Nest Site (Total chicks fledged/Total sites where egg was laid)
Ancient murrelet	Chicks Fledged/Egg (Total chicks fledged/Total eggs)
Auklets (except RHAU)	Chicks Fledged/Nest Site (Total chicks fledged/Total sites where egg was laid)
Rhinoceros auklet	Chicks Fledged/Egg (Total chicks fledged/Total eggs)
Puffins	Chicks Fledged/Egg (Total chicks fledged/Total eggs)

This report summarizes monitoring data for 2005, and compares 2005 results with previous years. For sites with at least two years of data prior to 2005, site averages were used for comparisons. Otherwise, prior estimates for nearby sites were utilized for comparisons. For chronology, we considered dates within 3 days of the long-term average to be "normal"; larger deviations represented relatively early or late dates. For productivity, we defined significant deviations from "normal" as any that differed by more than 20% from the site or regional average. Overall population trends were analyzed using linear regression models on log-transformed data (ln). Trends were considered to be significant at the $p<0.05$ level and are reported as percent per annum increase or decline. Care should be taken to note respective sample sizes when comparing population trends at different colonies. A significant trend at a small colony will have less impact at a regional or population level than a similar rate of change at a much larger colony.

Seabird diet information was collected from adult and nestling birds using a variety of methods, including stomach samples from collected birds, regurgitations, bill load observations and collection of bill loads. Diets of piscivorous birds are reported as percent occurrence, while diets of planktivorous birds (auklets) are reported as percent biomass of prey types.

For diet samples from piscivorous birds, we calculated the percent occurrence for each prey item by dividing the total number of samples in which that prey was recorded by the total number of samples in the data set. When data included stomach samples, we did not include empty stomachs in either the percent occurrence calculations or in the reported sample size for that data set.

We calculated the biomass for each identifiable prey item in each data set by first estimating the mass of that prey item in each sample. We did this by multiplying the count made in the laboratory analysis (often based on extrapolation from a split sample) by the mass of a single individual of that prey type. We used a standard mass for each prey item during the biomass calculations in order to make the results comparable over locations and years (Appendix 1). We then calculated the percent biomass by dividing the total mass of that prey item in the data set by the total estimated masses of all the identified prey items in the data set. In the event that a single prey item was recorded as "present" only, we estimated its mass by calculating the difference between the mass of all other prey items in the sample and the total sample mass measured in the field or in the lab, depending on which sample mass was provided in the data set. If more than one prey item was recorded as "present" only in a single sample, the sample was discarded from the analysis.

Diet results are reported in stacked bar graphs to facilitate viewing several years of data on one graph. For graphs of percent occurrence, the complete stacked bar indicates the cumulative percent occurrence of prey types in the samples and can add up to more than one hundred percent. The cumulative percent occurrence provides information on the average number of prey types per sample. For example, a cumulative percent occurrence of 200% for horned puffins indicates that on average each bird consumed two different prey types during one foraging trip and a cumulative percent occurrence of 100% indicates that on average each bird consumed one prey type during one foraging trip.

Diet graph titles include the sample type (chick or adult diet) followed by the collection method. Note that some chick diet information is actually based on samples collected from adults assumed to be carrying chick meals. Sample sizes are reported below each bar in each graph. In the event that more than one data type is represented in a single graph, sample sizes for each type are reported below the bars in the graph.

Results

Northern fulmar (*Fulmarus glacialis*)

Breeding chronology.–No data for 2005.

Productivity.–No data for 2005.

Populations.–We found no significant trends for northern fulmars at any monitored colony (Figure 2).

Diet.–No data.

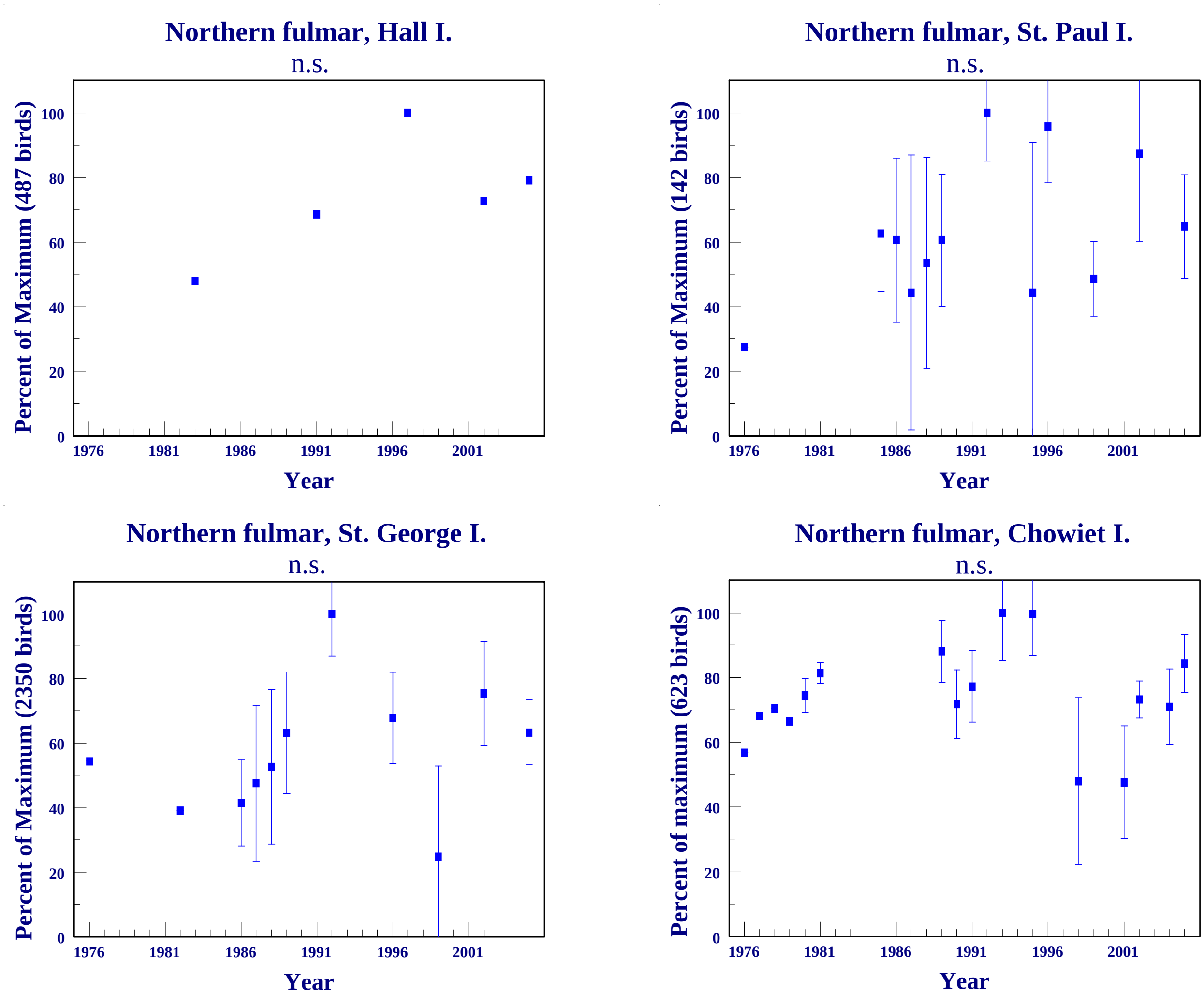


Figure 2. Trends in populations of northern fulmars at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001.

Fork-tailed storm-petrel (*Oceanodroma furcata*)

Breeding chronology.–The mean hatch date for fork-tailed storm-petrels was about average at Aiktak and St. Lazaria islands in 2005 (Table 2, Fig. 3).

Table 2. Hatching chronology of fork-tailed storm-petrels at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Aiktak I.	11 Jul (45)[a]	14 Jul (45)	16 Jul[b] (8)[a]	Helm and Zeman 2006
St. Lazaria I.	—	13 Jul (50)	14 Jul[b] (10)	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–In 2005, productivity of fork-tailed storm-petrels was about average at all monitored sites (Table 3, Fig. 4).

Table 3. Reproductive performance of fork-tailed storm-petrels at Alaskan sites monitored in 2005.

Site	Chicks Fledged[a]/Egg	No. of Plots	Long-term Average	Reference
Buldir I.	0.73	5 (64)[b]	0.72 (19)[b]	Andersen and Barrett 2006
Ulak I.	0.60	1 (42)	0.65 (9)	Drummond and Rehder 2005
Kasatochi I	0.49	N/A (71)	N/A[c]	Drummond and Rehder 2005
Aiktak I.	0.80	N/A (51)	0.73 (8)	Helm and Zeman 2006
St. Lazaria I.	0.70	8 (122)	0.68 (11)	L. Slater Unpubl. Data

[a]Fledged chick defined as being still alive at last check in August or September.
[b]Sample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.
[c]Not applicable or not reported.

Populations.–Fork-tailed and Leach's storm-petrel burrows were combined at most sites for population monitoring purposes. Storm-petrel populations increased by 1.3% per annum at St. Lazaria Island (Fig. 5). No other monitored colonies exhibited significant trends.

Diet.–Diets of fork-tailed storm-petrels at Buldir and Kasatochi islands consisted of a majority of myctophids, other larval fish and amphipods (Fig. 6). In a small sample from Aiktak Island, diet consisted entirely of *Parathemisto* spp. and sand lance. Diets from St. Lazaria Island consisted of a majority of myctophids and other larval fish

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

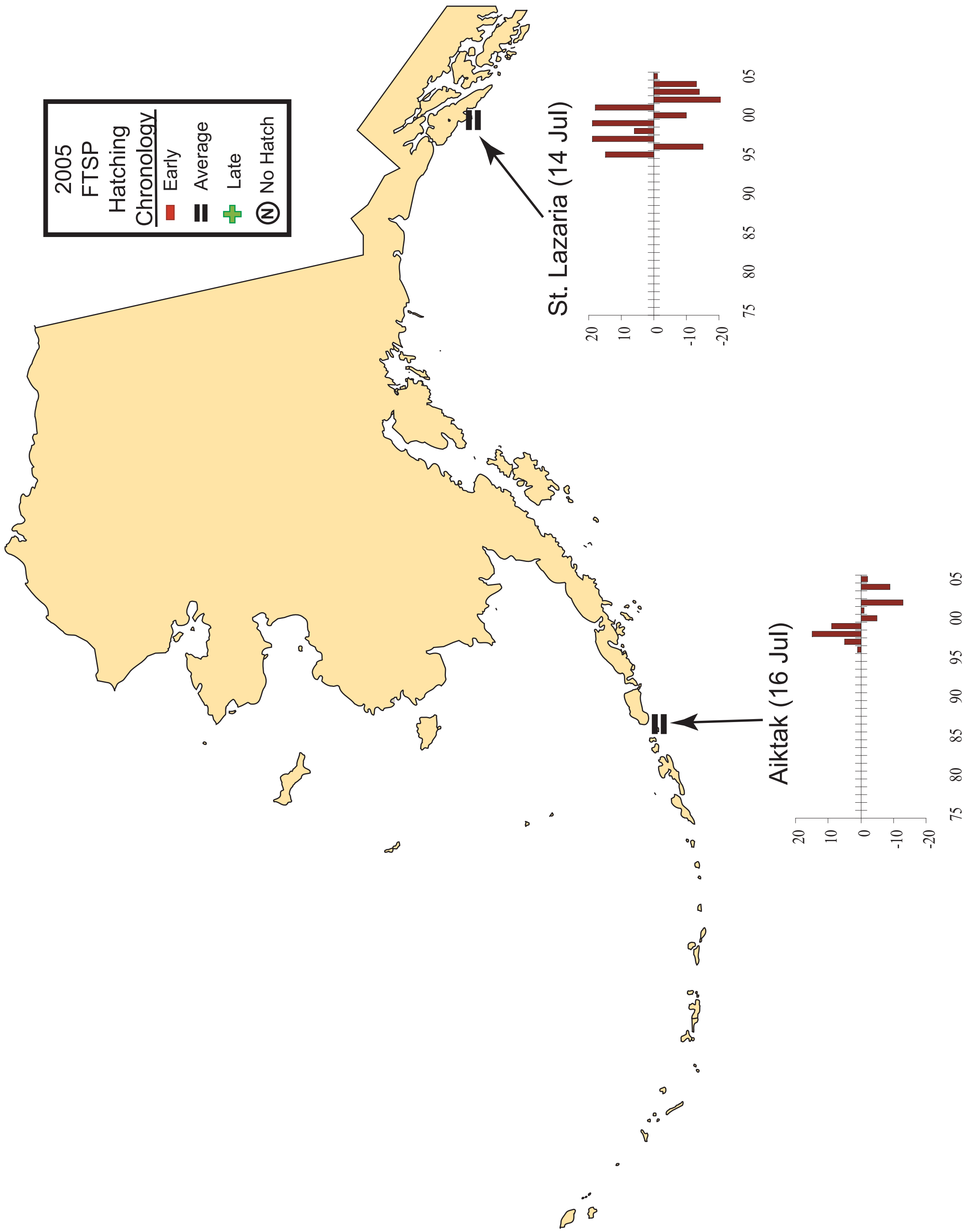


Figure 3. Hatching chronology of fork-tailed storm-petrels at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

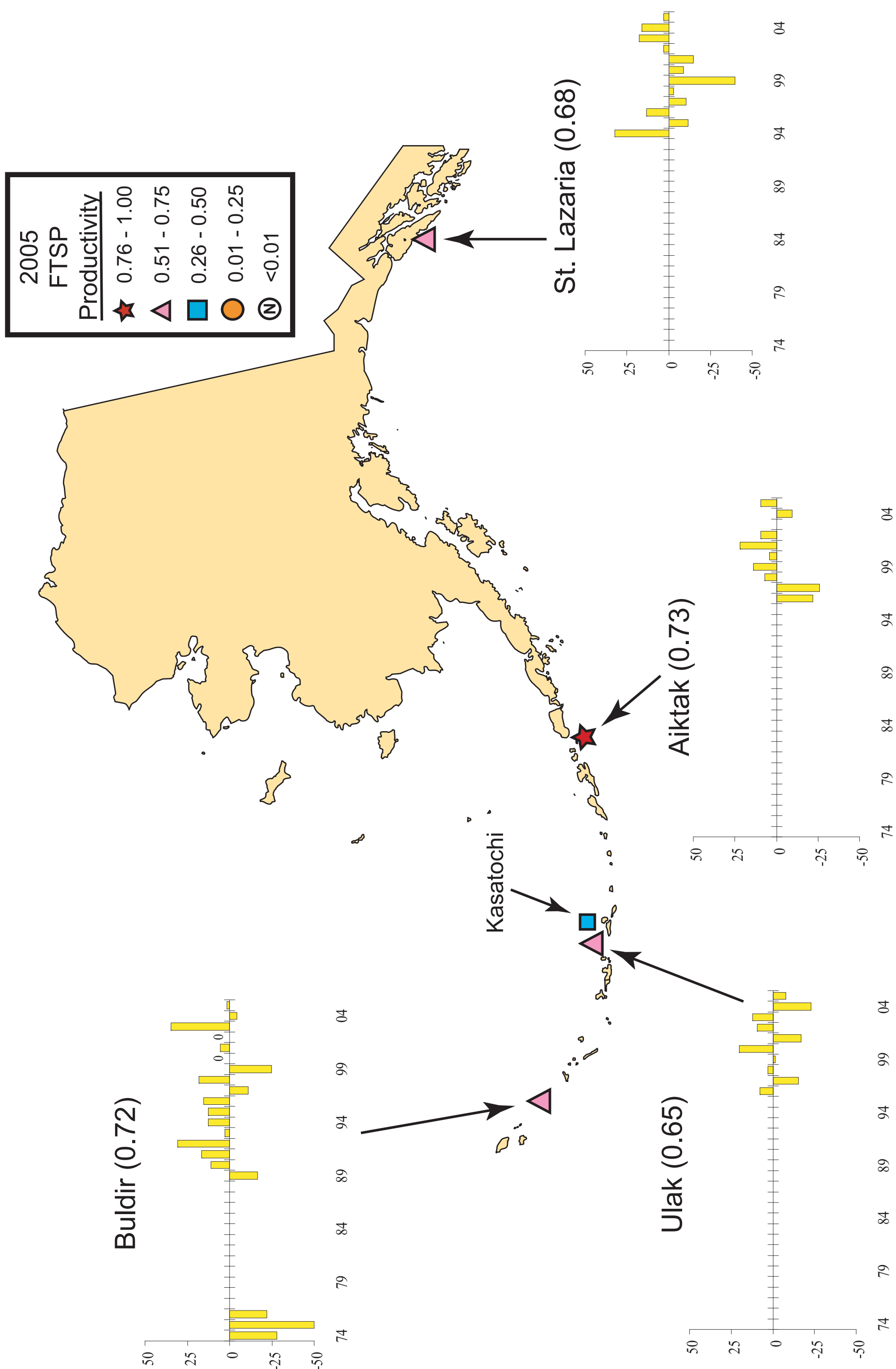


Figure 4. Productivity of fork-tailed storm-petrels (chicks fledged/egg) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

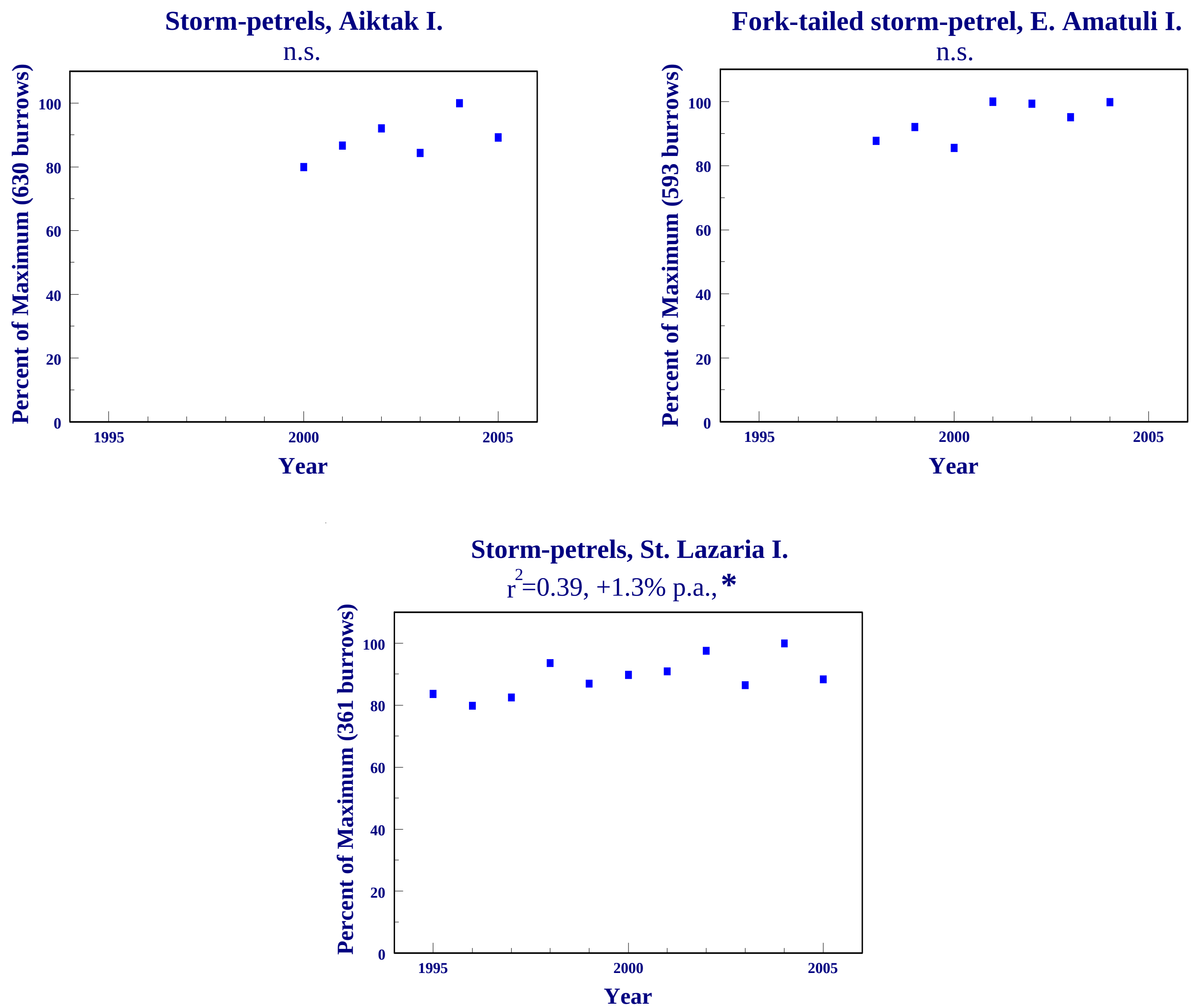


Figure 5. Trends in populations of storm-petrels at Alaskan sites. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

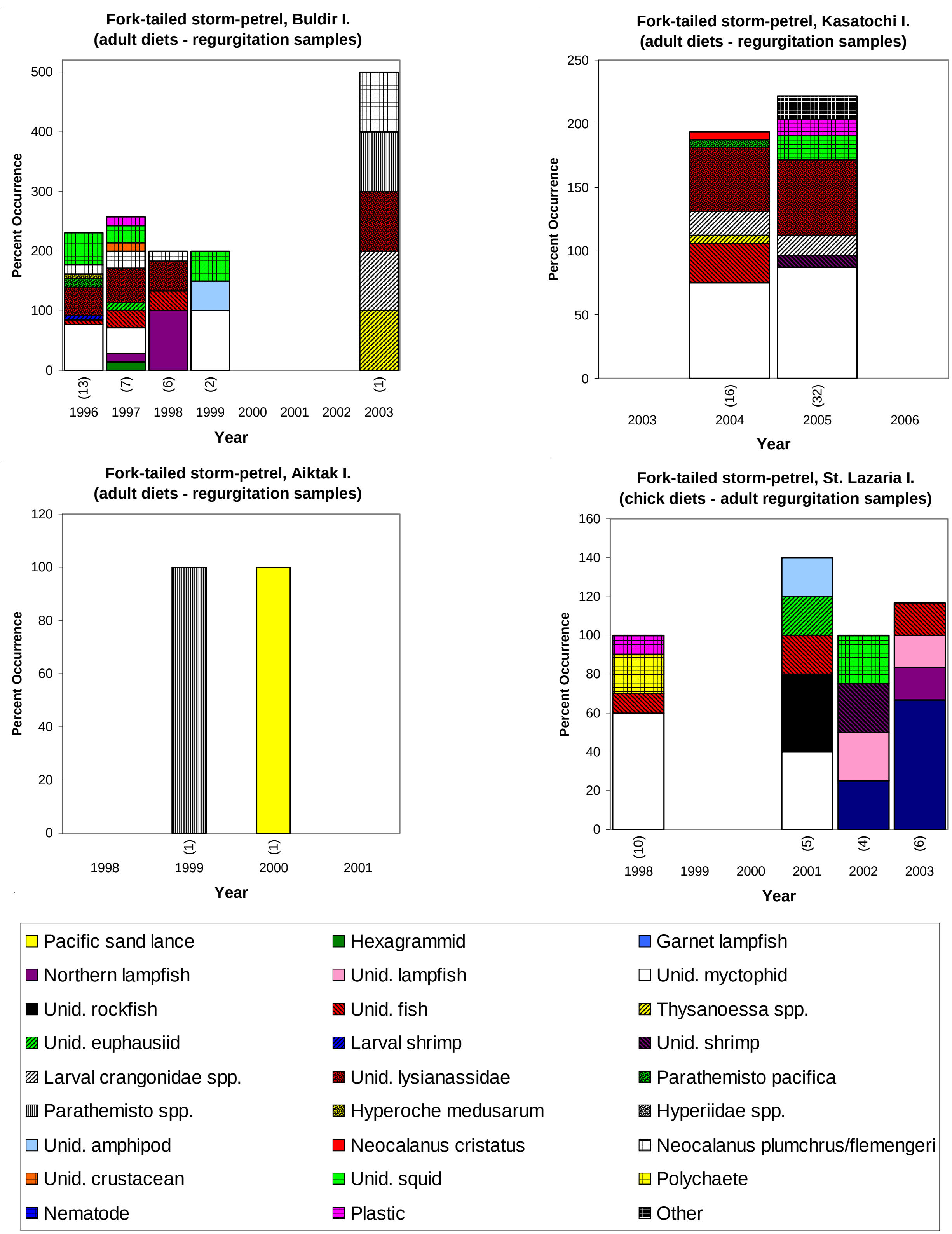


Figure 6. Diets of fork-tailed storm-petrels at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

Leach's storm-petrel (*Oceanodroma leucorhoa*)

Breeding chronology.–The mean hatch date for Leach's storm-petrels was earlier than average at Aiktak and St. Lazaria islands in 2005 (Table 4, Fig. 7).

Table 4. Hatching chronology of Leach's storm-petrels at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Aiktak I.	23 Jul (44)[a]	27 Jul (44)	2 Aug[b] (8)[a]	Helm and Zeman 2006
St. Lazaria I.	—	26 Jul (24)	1 Aug[b] (10)	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.

[b]Mean of annual means.

Productivity.–In 2005, productivity of Leach's storm-petrels was about average at all monitored sites (Table 5, Fig. 8).

Table 5. Reproductive performance of Leach's storm-petrels at Alaskan sites monitored in 2005.

Site	Chicks Fledged[a]/Egg	No. of Plots	Long-term Average	Reference
Buldir I.	0.74	5 (77)[b]	0.74 (19)[b]	Andersen and Barrett 2006
Aiktak I.	0.77	N/A[c] (52)	0.67 (8)	Helm and Zeman 2006
St. Lazaria I.	0.69	8 (113)	0.68 (11)	L. Slater Unpubl. Data

[a]Fledged chick defined as being still alive at last check in August or September.

[b]Sample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

[c]Not applicable or not reported.

Populations.–Fork-tailed and Leach's storm-petrel burrows were combined at most sites for population monitoring purposes. Storm-petrel populations increased by 1.3% per annum at St. Lazaria Island (Fig. 5). No other monitored colonies exhibited significant trends.

Diet.–Diets of Leach's storm-petrels at Buldir and St. Lazaria islands consisted mainly of larval fish and small crustaceans (Fig. 9). In a small sample from Aiktak Island, diet consisted entirely of fish.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

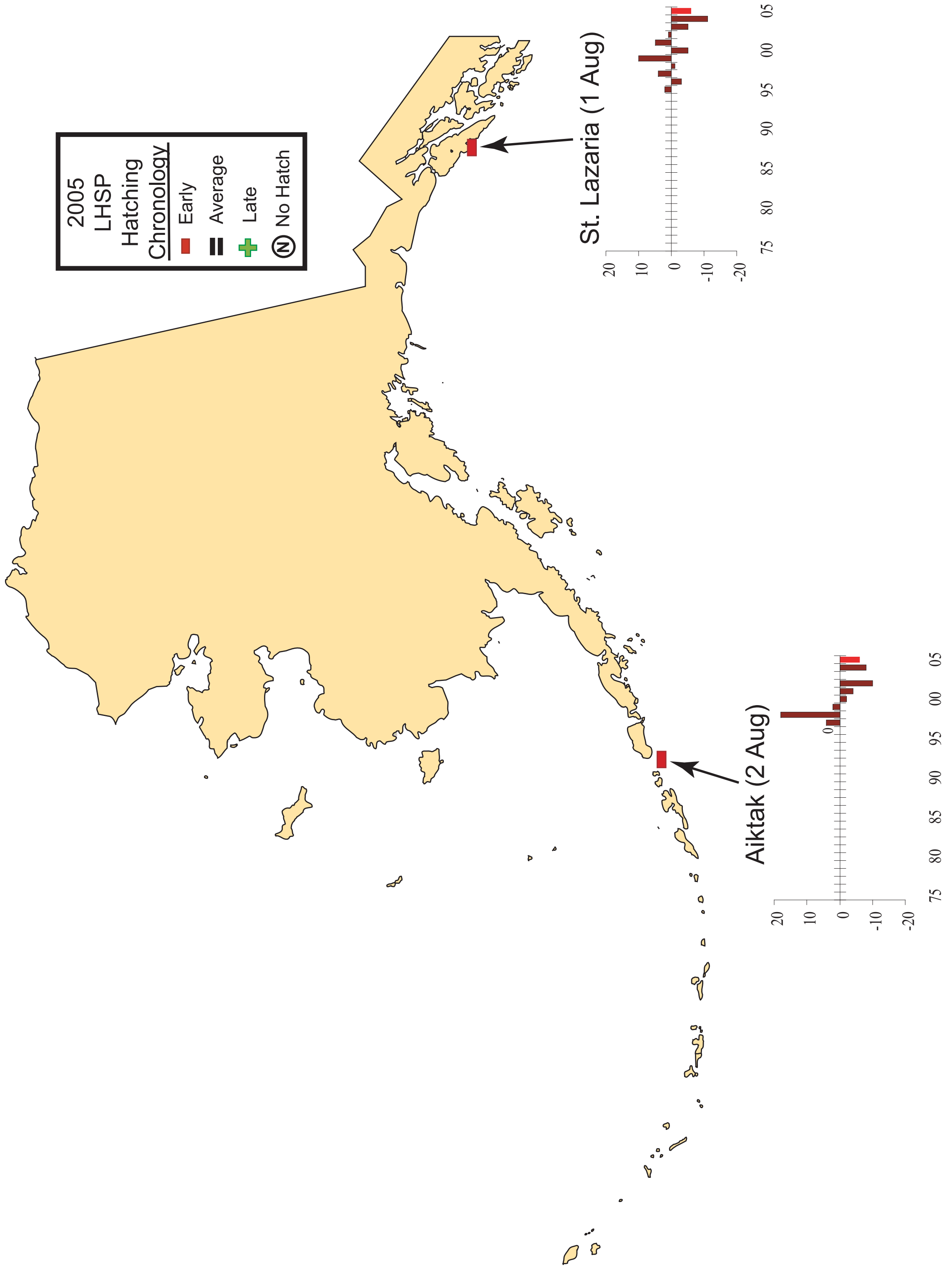


Figure 7. Hatching chronology of Leach’s storm-petrels at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

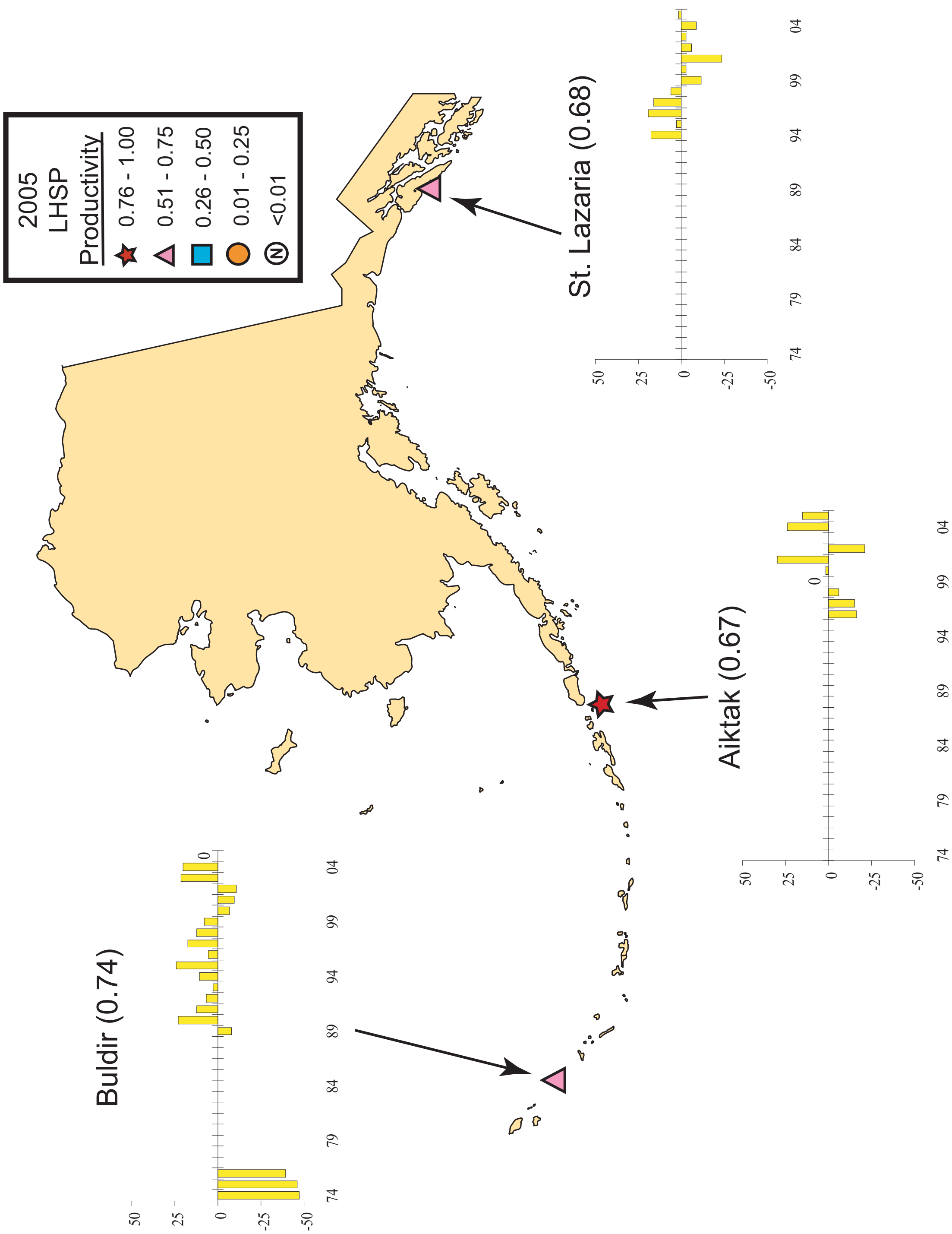


Figure 8. Productivity of Leach’s storm-petrels (chicks fledged/egg) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

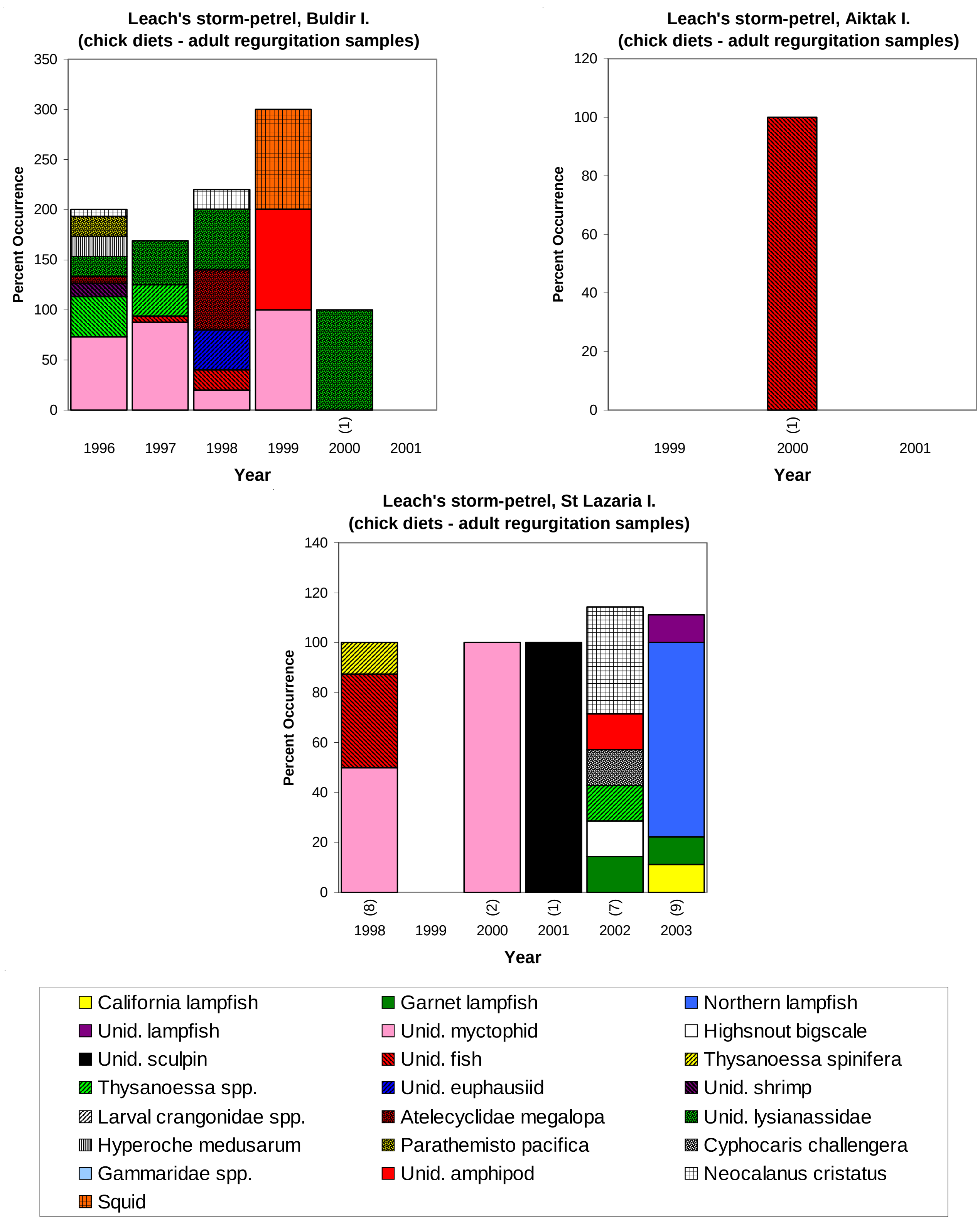


Figure 9. Diets of Leach's storm-petrels at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes, when available, are reported below each bar.

Red-faced cormorant (*Phalacrocorax urile*)

Breeding chronology.–Timing of hatching of red-faced cormorant eggs was about average at St. Paul Island in 2005 (Table 6). Mean hatch date at St. George Island was similar to the long-term average at St. Paul Island.

Table 6. Hatching chronology of red-faced cormorants at Alaskan sites monitored in 2005.

Site	Mean	Long-term Average	Reference
St. Paul I.	25 Jun (111)[a]	27 Jun[b] (16)[a]	Wright et al. 2007
St. George I.	29 Jun (13)	N/A[c]	Thomson 2007

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.
[c]Not applicable or not reported.

Productivity.–In 2005, productivity of red-faced cormorants was below average at all monitored colonies, except St. George Island, where success was about average (Table 7, Fig. 10).

Table 7. Reproductive performance of red-faced cormorants at Alaskan sites monitored in 2005.

Site	Chicks Fledged/Nest	No. of Plots	Long-term Average	Reference
St. Paul I.	0.93	9 (258)[a]	1.25(23)[a]	Wright et al. 2007
St. George I.	1.30	2 (64)	1.49 (8)	Thomson 2007
Buldir I.	0.50	N/A[b] (6)	1.24 (2)	Andersen and Barrett 2006
Amatignak I.	1.59[c]	N/A (68)	N/A	Byrd et al. 2005
Ulak I.	0.00[c]	N/A (0)	1.64 (8)	Drummond and Rehder 2005
Kasatochi I.	0.00	N/A (2)	1.12 (9)	Drummond and Rehder 2005
Bogoslof I.	0.64[c]	N/A (22)	N/A	Renner and Williams 2005

[a]Sample size in parentheses represents the number of nests used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.
[b]Not applicable or not reported.
[c]Value obtained from one time visit to colony.

Populations.–Red-faced cormorants were differentiated from other cormorants at only one colony. We found a significant decline (-13.3% per annum) at Chiniak Bay (Fig. 11). See the section covering pelagic cormorants for a discussion of general cormorant population trends at colonies where the species are combined.

Diet.–No data.

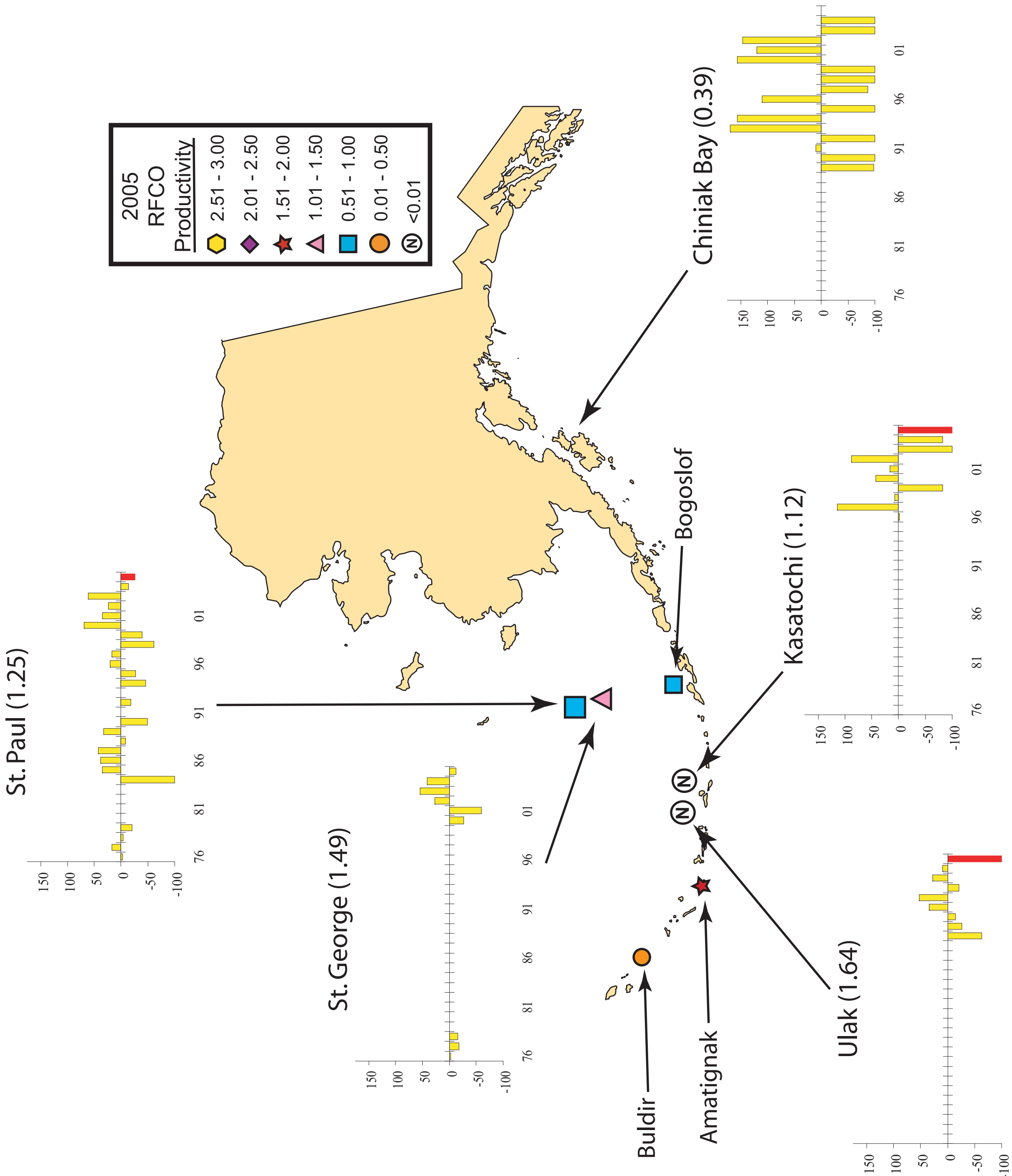


Figure 10. Productivity of red-faced cormorants (chicks fledged/nest) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

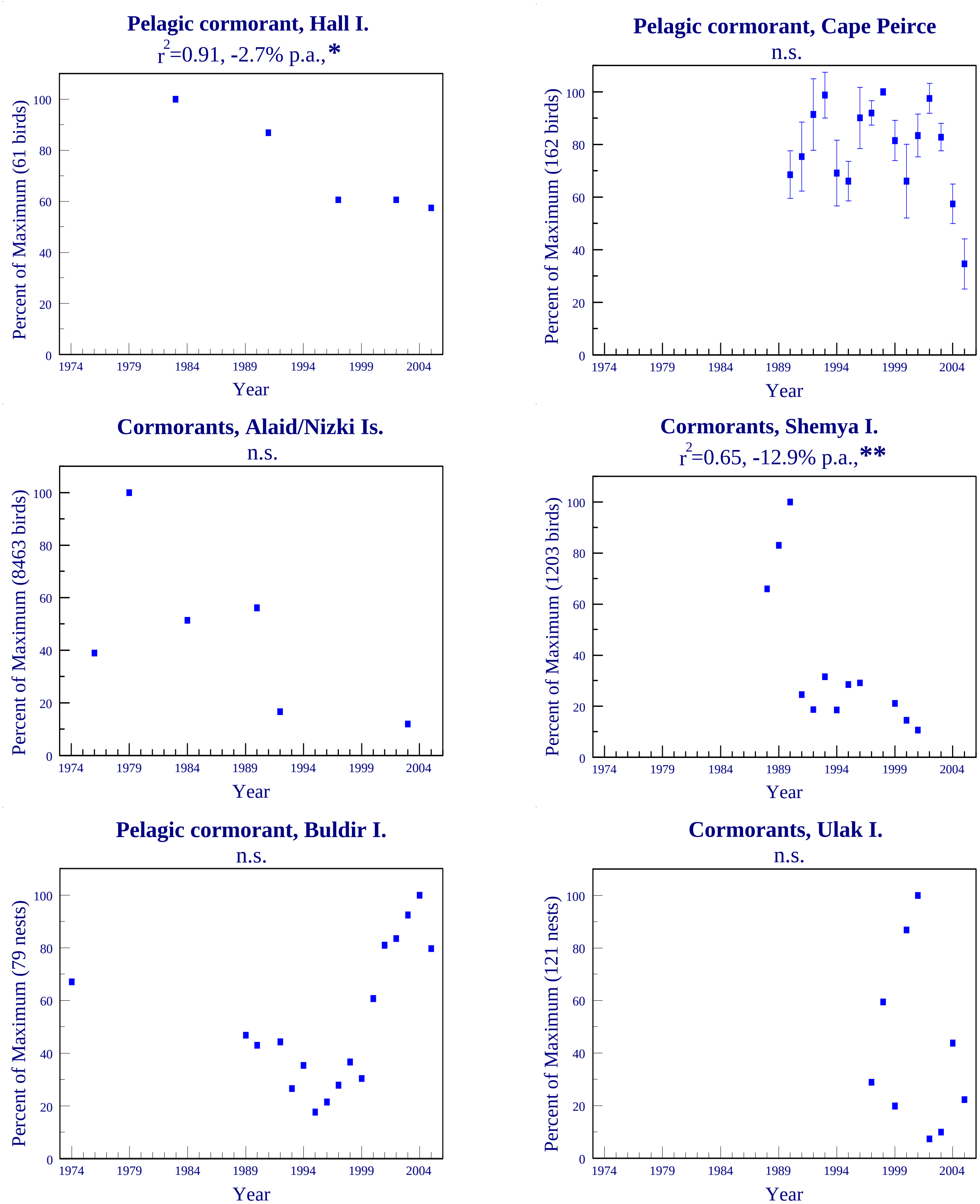


Figure 11. Trends in populations of cormorants at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

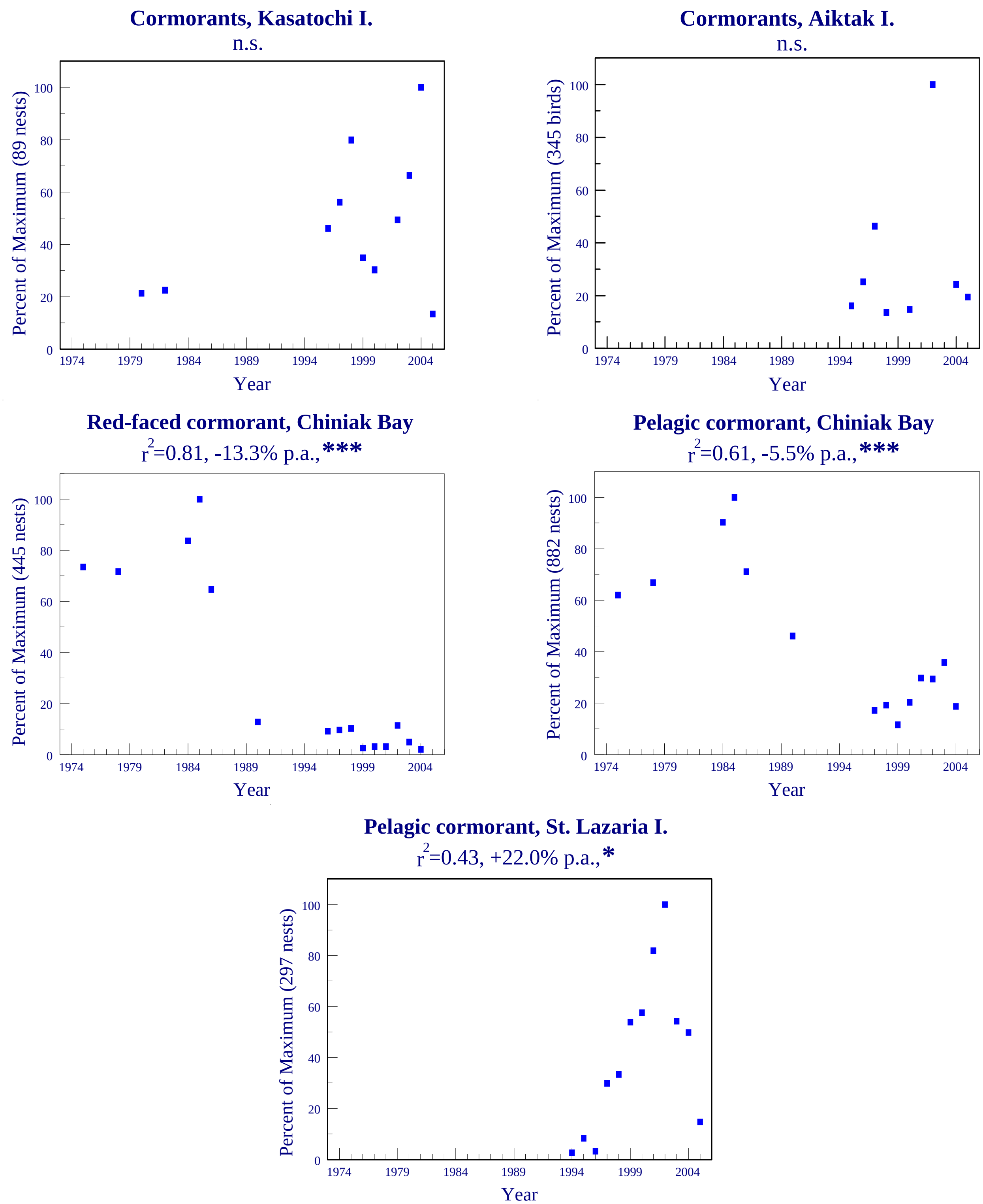


Figure 11 (continued). Trends in populations of cormorants at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

Pelagic cormorant (*Phalacrocorax pelagicus*)

Breeding chronology.–Hatching dates for pelagic cormorants were about average at Cape Peirce in 2005 (Table 8).

Table 8. Hatching chronology of pelagic cormorants at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Cape Peirce	—	21 Jun (10)[a]	20 Jun[b] (13)[a]	R. MacDonald Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Pelagic cormorant productivity was below average at all monitored sites in 2005 (Table 9, Fig. 12).

Table 9. Reproductive performance of pelagic cormorants at Alaskan sites monitored in 2005.

Site	Chicks Fledged/Nest	No. of Plots	Long-term Average	Reference
Bluff	1.97	N/A[a] (35)[b]	N/A	Murphy 2005
Cape Peirce	0.57	6 (21)	1.33 (19)[b]	R. MacDonald Unpubl. Data
Buldir I.	0.37	N/A (63)	1.02 (15)	Andersen and Barrett 2006
Ulak I.	1.00[c]	N/A (9)	1.70 (7)	Drummond and Rehder 2005
Kasatochi I.	0.00	N/A (2)	1.10 (9)	Drummond and Rehder 2005
St. Lazaria I.	0.10	N/A (44)	0.68 (11)	L. Slater Unpubl. Data

[a]Not applicable or not reported.
[b]Sample size in parentheses represents the number of nests used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.
[c]Value obtained from one time visit to colony.

Populations.–Cormorants are known to shift nesting locations between years, so it is difficult to confidently interpret changes in counts. Nevertheless, numbers of pelagic cormorants or nests (the index that has been used at some sites) have remained relatively stable at two monitored sites (Fig. 11). We found a significant negative trend for pelagic cormorants at Hall Island (-2.7% per annum) and Chiniak Bay (-5.5% per annum) and an increase in pelagic cormorants at St. Lazaria Island (+22.0% per annum). Cormorants (species combined) showed no trends at most sites but declined at Shemya Island (-12.9% per annum).

Diet.–Pelagic cormorants from St. Lazaria Island predominately ate Pacific sand lance and sculpin, with lesser amounts of other fish species (Fig. 13).

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

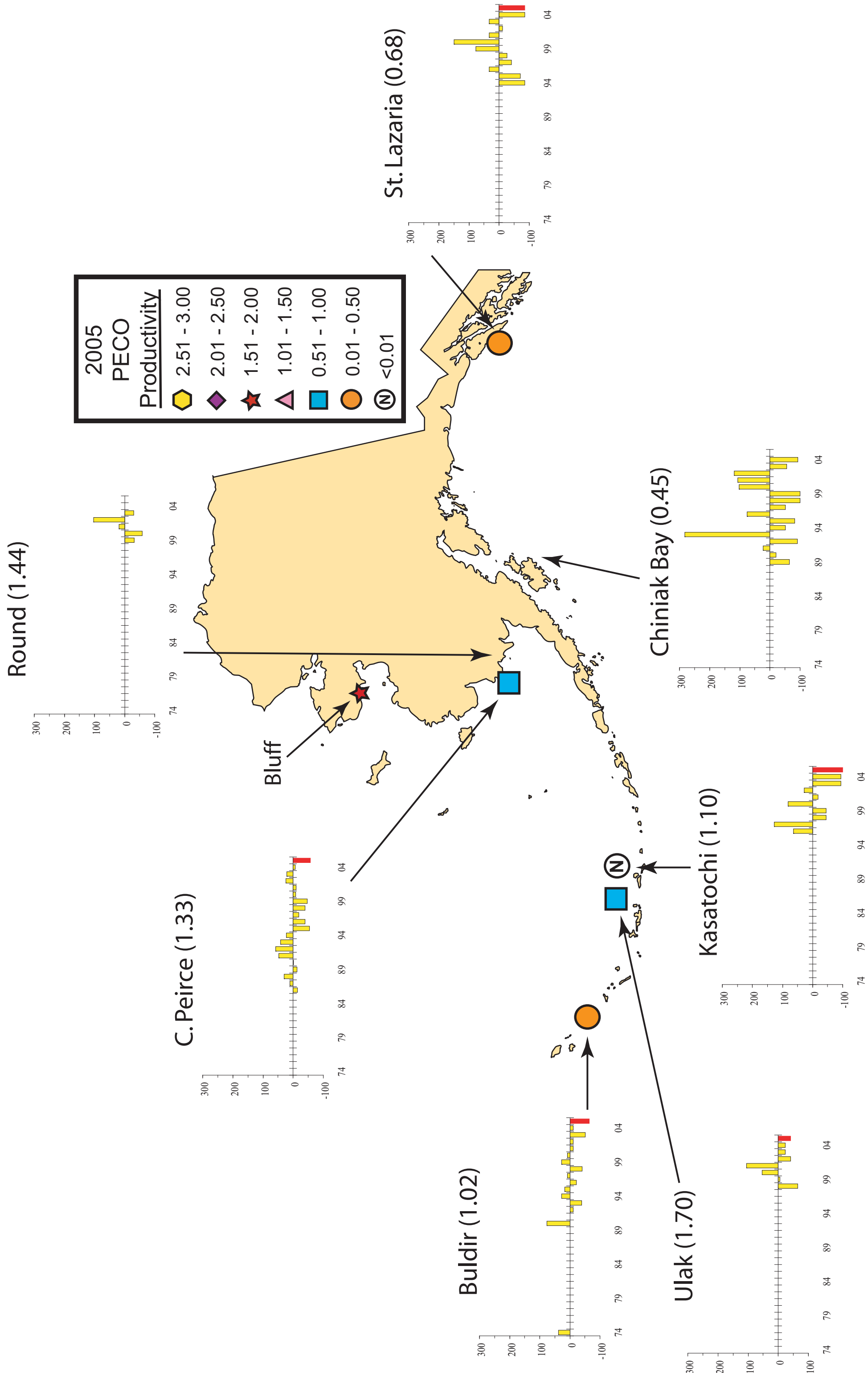


Figure 12. Productivity of pelagic cormorants (chicks fledged/nest) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

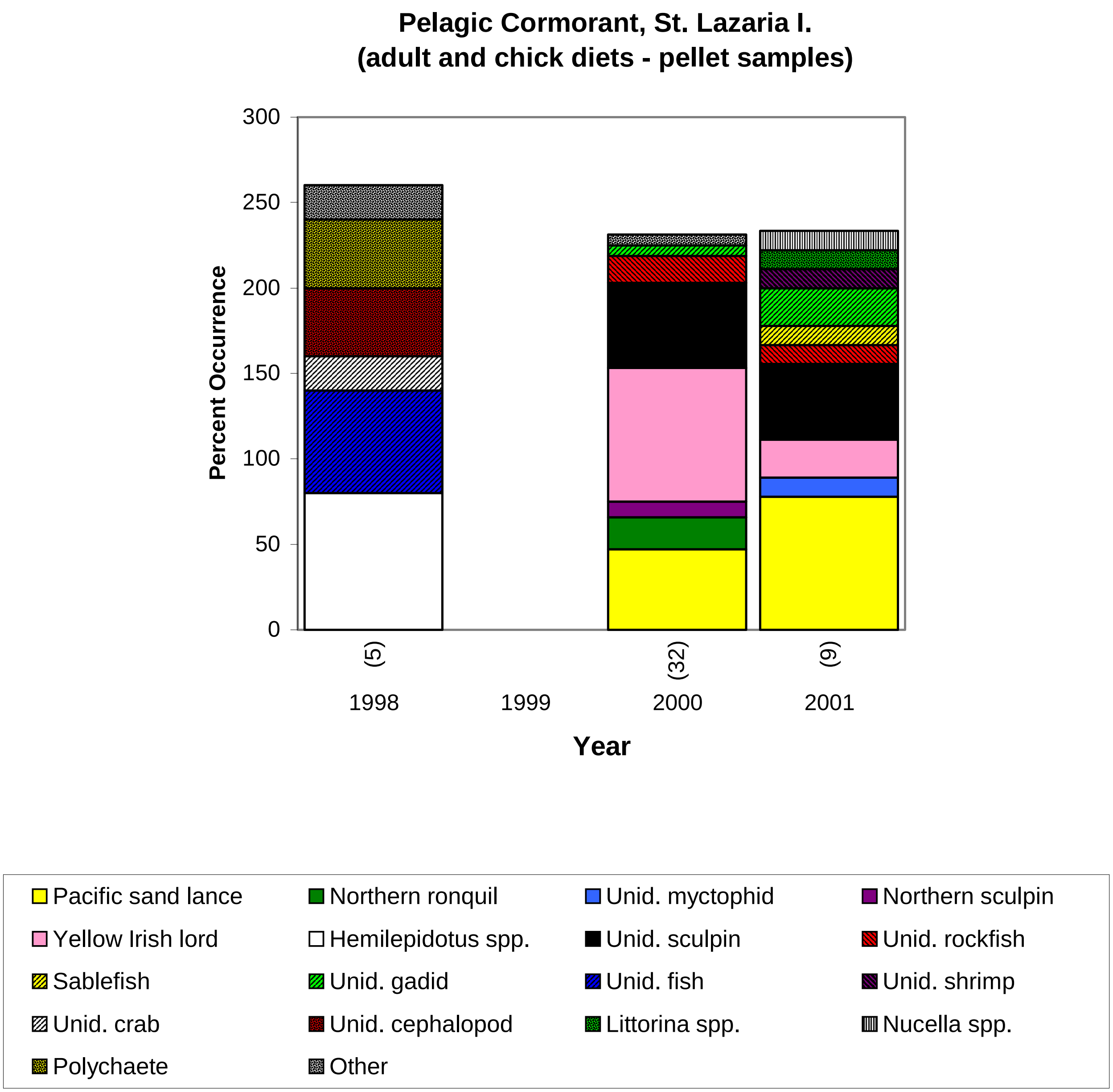


Figure 13. Diets of pelagic cormorants at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

Glaucous-winged gull *(Larus glaucescens)*

Breeding chronology.–In 2005 glaucous-winged gull mean hatch date was earlier than average at Aiktak Island and late at St. Lazaria Island (Table 10, Fig. 14).

Table 10. Hatching chronology of glaucous-winged gulls at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Aiktak I.	3 Jul (79)[a]	3 Jul (79)	8 Jul[b] (10)[a]	Helm and Zeman 2006
Chowiet I.	6 Jul (18)	5 Jul (18)	N/A[c]	Helm and Zeman 2007
St. Lazaria I.	6 Jul (18)	5 Jul (18)	1 Jul[b] (6)	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.
[c]Not applicable or not reported.

Productivity.–Glaucous-winged gull hatching success in 2005 was average at three of the four monitored sites, and below average at Aiktak Island (Table 11, Fig. 15).

Table 11. Reproductive performance of glaucous-winged gulls at Alaskan sites monitored in 2005.

Site	Hatching Success[a]	No. of Plots	Long-term Average	Reference
Buldir I.	0.28	N/A[b] (60)[c]	0.28 (13)[c]	Andersen and Barrett 2006
Aiktak I.	0.58	N/A (300)	0.79 (10)	Helm and Zeman 2006
Chowiet I.	0.36	3 (105)	0.39 (4)	Helm and Zeman 2007
St. Lazaria I.	0.55	N/A	0.64 (10)	L. Slater Unpubl. Data

[a]Total chicks/Total eggs.
[b]Not applicable or not reported.
[c]Sample size in parentheses represents the number of eggs used to calculate hatching success and the number of years used to calculate the long-term average. Current year not used in long-term average.

Populations.–We found a significant negative trend at Buldir Island (-17.5% per annum) and an increase at St. Lazaria Island (+11.8% per annum, Fig. 16). No trends were evident at other monitored colonies.

Diet.–Glaucous-winged gulls from Buldir Island predominately ate sea urchins and avian prey, while gulls from Prince William Sound mostly ate herring, capelin and invertebrate prey at Eleanor Island, and invertebrates and salmon eggs at the Shoup Bay colony (Fig. 17). A small sample from St. Lazaria Island included *Mya* spp., sand lance and unidentified fish. Gull diet at Aiktak Island consisted primarily of fish in most years.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the “other” category.

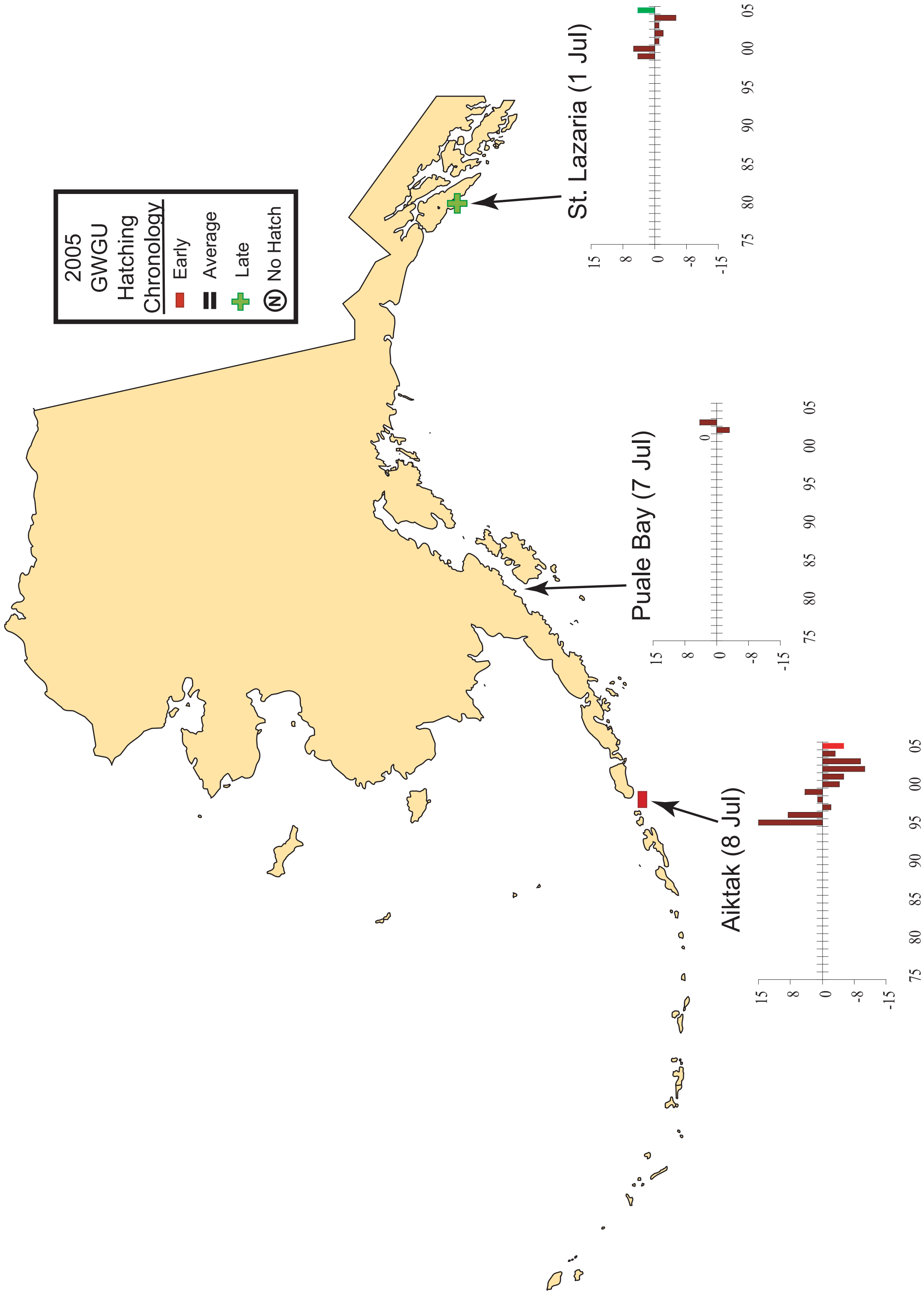


Figure 14. Hatching chronology of glaucous-winged gulls at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

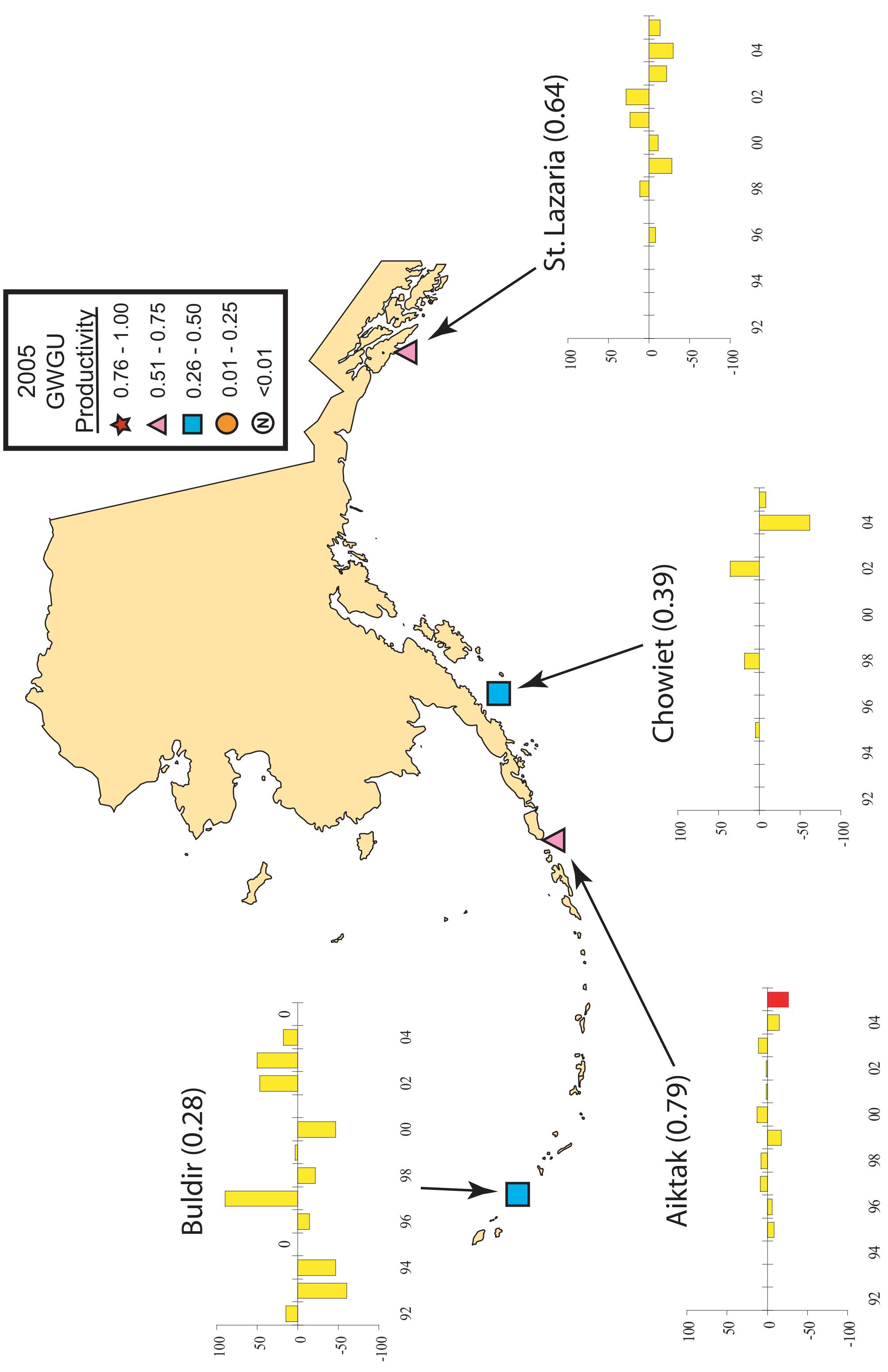


Figure 15. Productivity of glaucous-winged gulls (hatching success) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

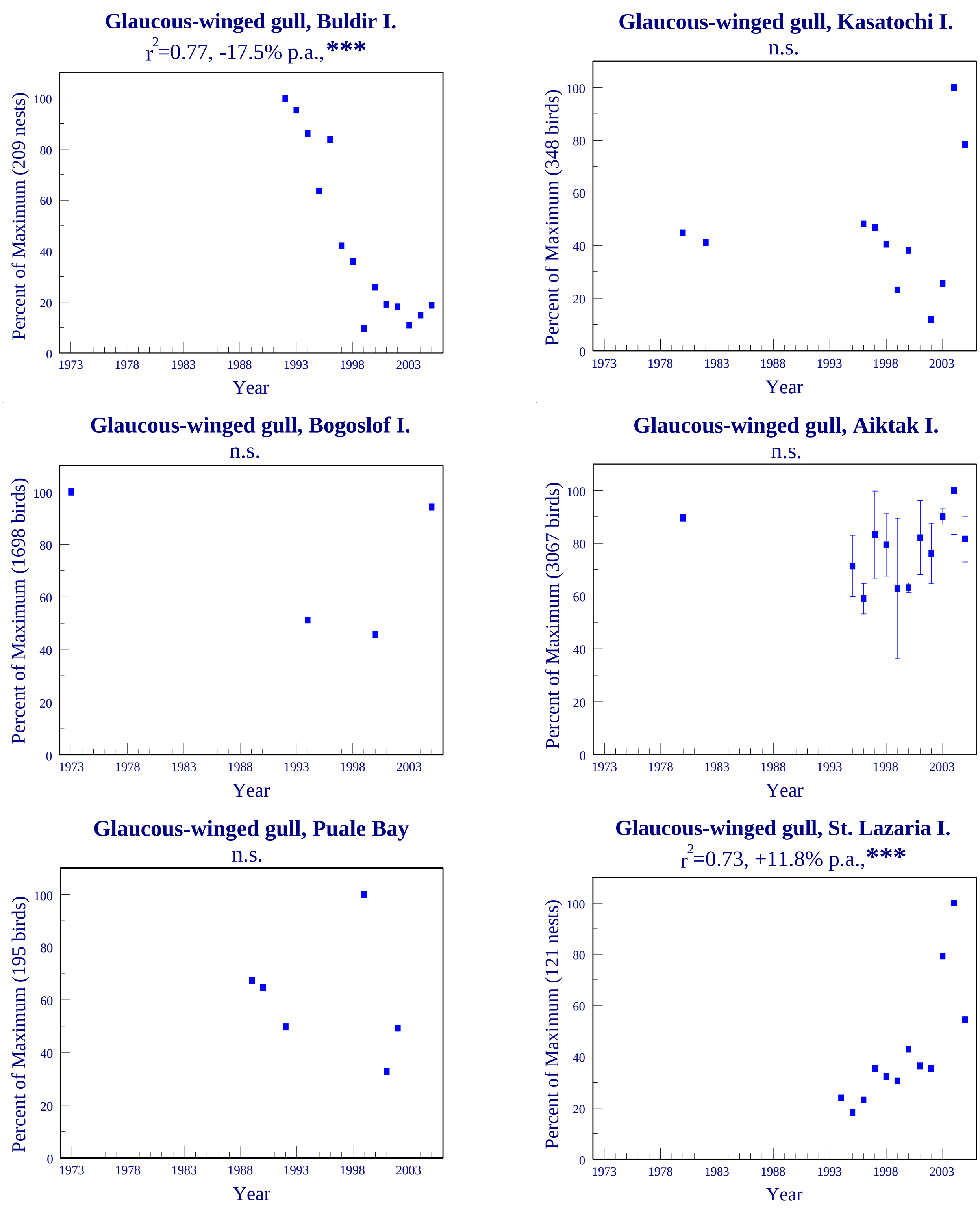


Figure 16. Trends in populations of glaucous-winged gulls at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

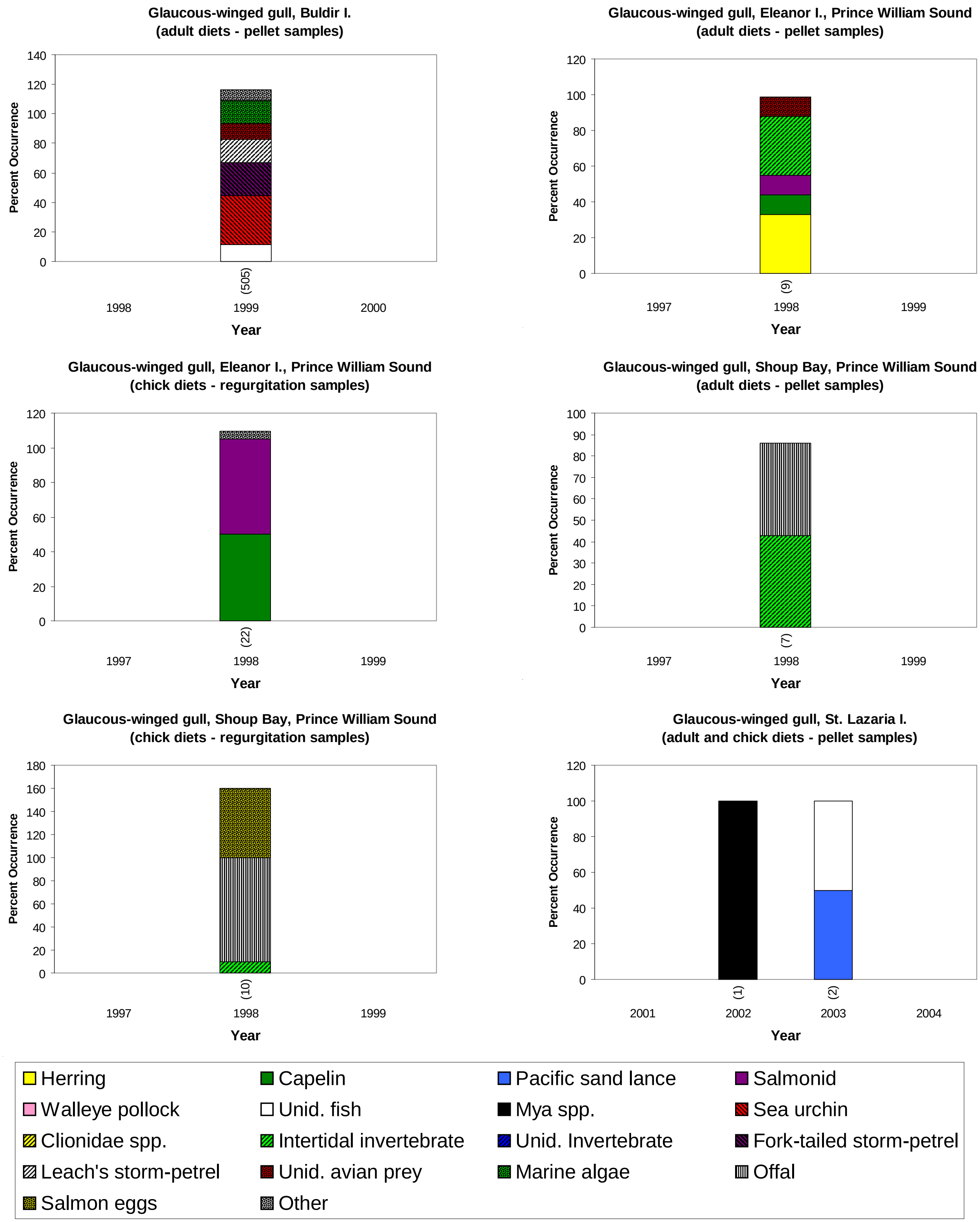


Figure 17. Diets of glaucous-winged gulls at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

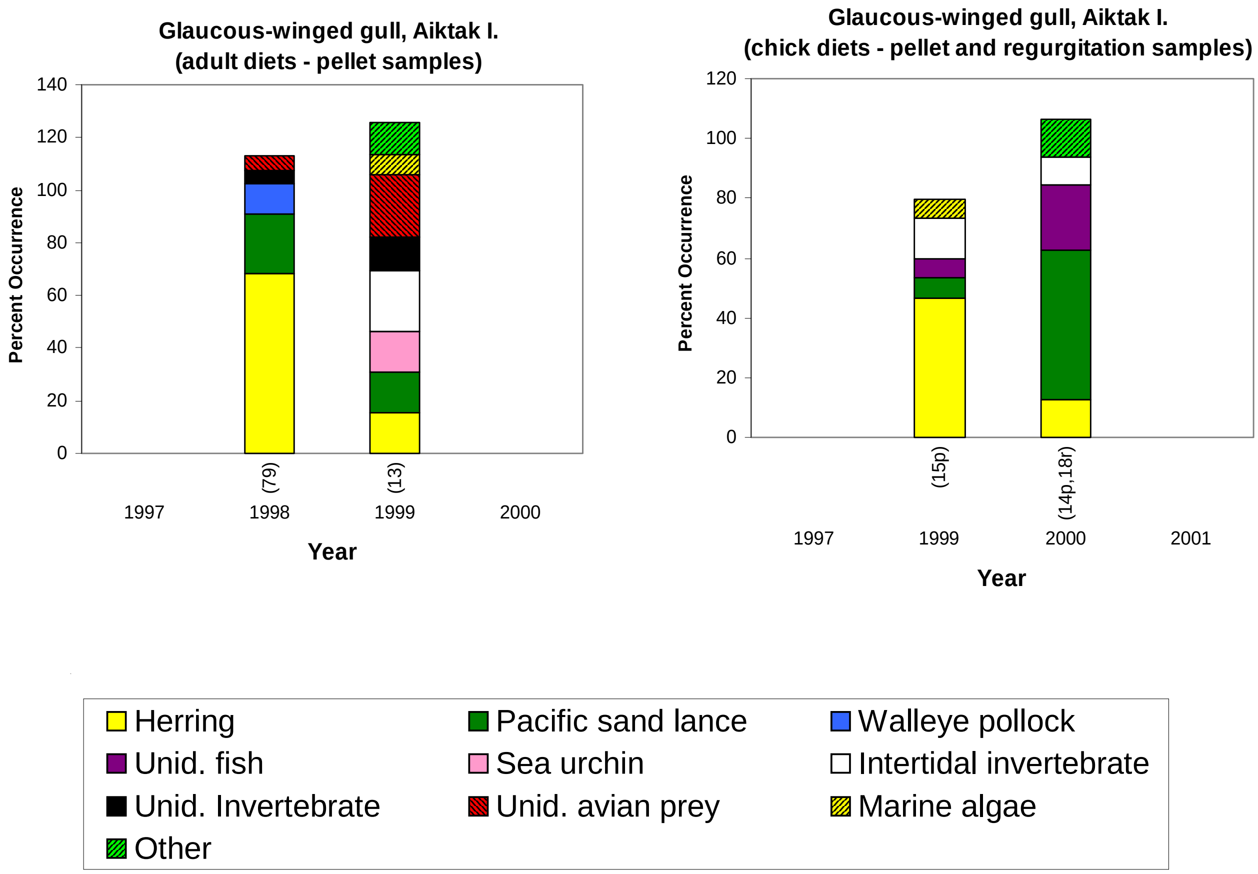


Figure 17 (continued). Diets of glaucous-winged gulls at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

Black-legged kittiwake (*Rissa tridactyla*)

Breeding chronology.–In 2005, black-legged kittiwake hatching was early at Bluff and Cape Peirce, late at Buldir and Chowiet islands, and about average at St. Paul, St. George and E. Amatuli islands (Table 12, Fig. 18).

Table 12. Hatching chronology of black-legged kittiwakes at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Bluff	—	21 Jul (N/A[c])[a]	25 Jul[b] (26)[a]	Murphy 2005
St. Paul I.	—	20 Jul (52)	21 Jul[b] (21)	Wright et al. 2007
St. George I.	—	17 Jul (11)	18 Jul[b] (20)	Thomson 2007
Cape Peirce	—	4 Jul (117)	9 Jul[b] (16)	R. MacDonald Unpubl. Data
Buldir I.	11 Jul (6)	12 Jul (6)	6 Jul[b] (17)	Andersen and Barrett 2006
Chowiet I.	29 Jul (25)	31 Jul (25)	17 Jul[b] (11)	Helm and Zeman 2007
E. Amatuli I.	9 Jul (12)	9 Jul (12)	12 Jul[b] (11)	A. Kettle, Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.
[c]Not applicable or not reported.

Productivity.–Productivity of black-legged kittiwakes was below average at all but two of the monitored colonies in 2005. Success was average at Cape Peirce and Bogoslof Island (Table 13, Fig. 19).

Populations.–Significantly negative population trends occurred at Hall (-3.6% per annum), St. Paul (-3.2%), Chowiet (-1.7%) islands and at Cape Peirce (-6.4%, Fig. 20). Significant increases have occurred at Buldir Island (+5.2% per annum) and Prince William Sound (+1.6%). No other monitored colonies exhibited significant population changes.

Diet.–Black-legged kittiwakes from Cape Lisburne predominately ate small fish prey, including sand lance, sculpin, gadids and cod (Fig. 21). Diets from St. Paul Island included primarily myctophids, walleye pollock, squid and a variety of other small fish and invertebrates. Black-legged kittiwakes from St. George Island ate primarily myctophids, pollock, euphausiids and squid, with lesser amounts of other larval fish and small invertebrates. Chicks from Buldir Island ate predominately myctophids, greenling, euphausiids, amphipods and shrimp, with a variety of other larval fish and small invertebrates as lesser prey items. Diet samples from Koniuji Island included primarily myctophids with lesser occurrences of greenling and euphausiids. Bogoslof Island adults and chicks ate predominately myctophids along with lesser amounts of other larval fish and small crustaceans. Barren Island diet samples included capelin, smelt and sand lance for chicks and euphausiids, shrimp, amphipods and copepods for a small sample of adults. Kittiwakes from the Semidi Islands and East Amatuli Island ate predominately capelin and sandlance. Shoup Bay kittiwakes ate primarily herring and sand lance.

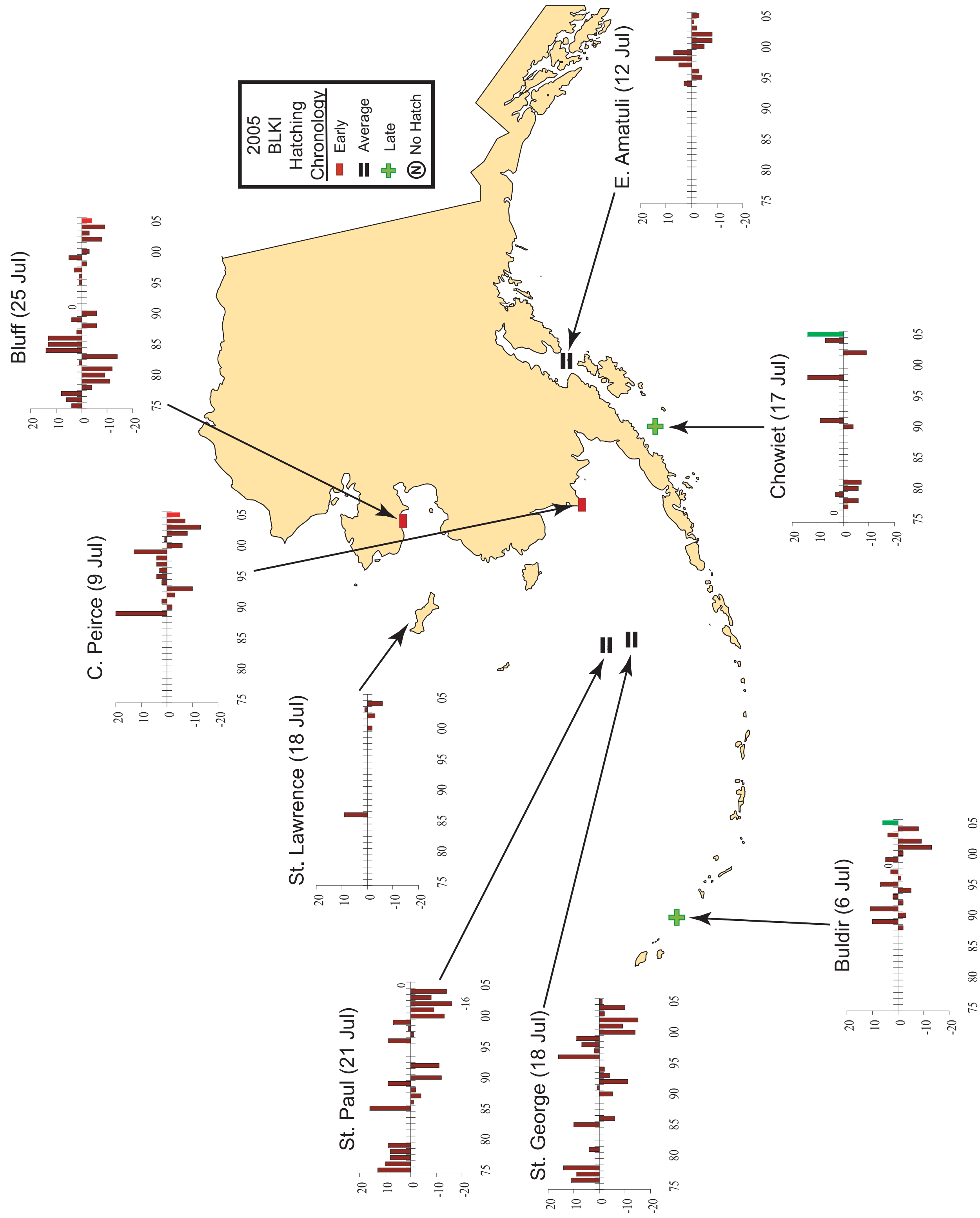


Figure 18. Hatching chronology of black-legged kittiwakes at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included)

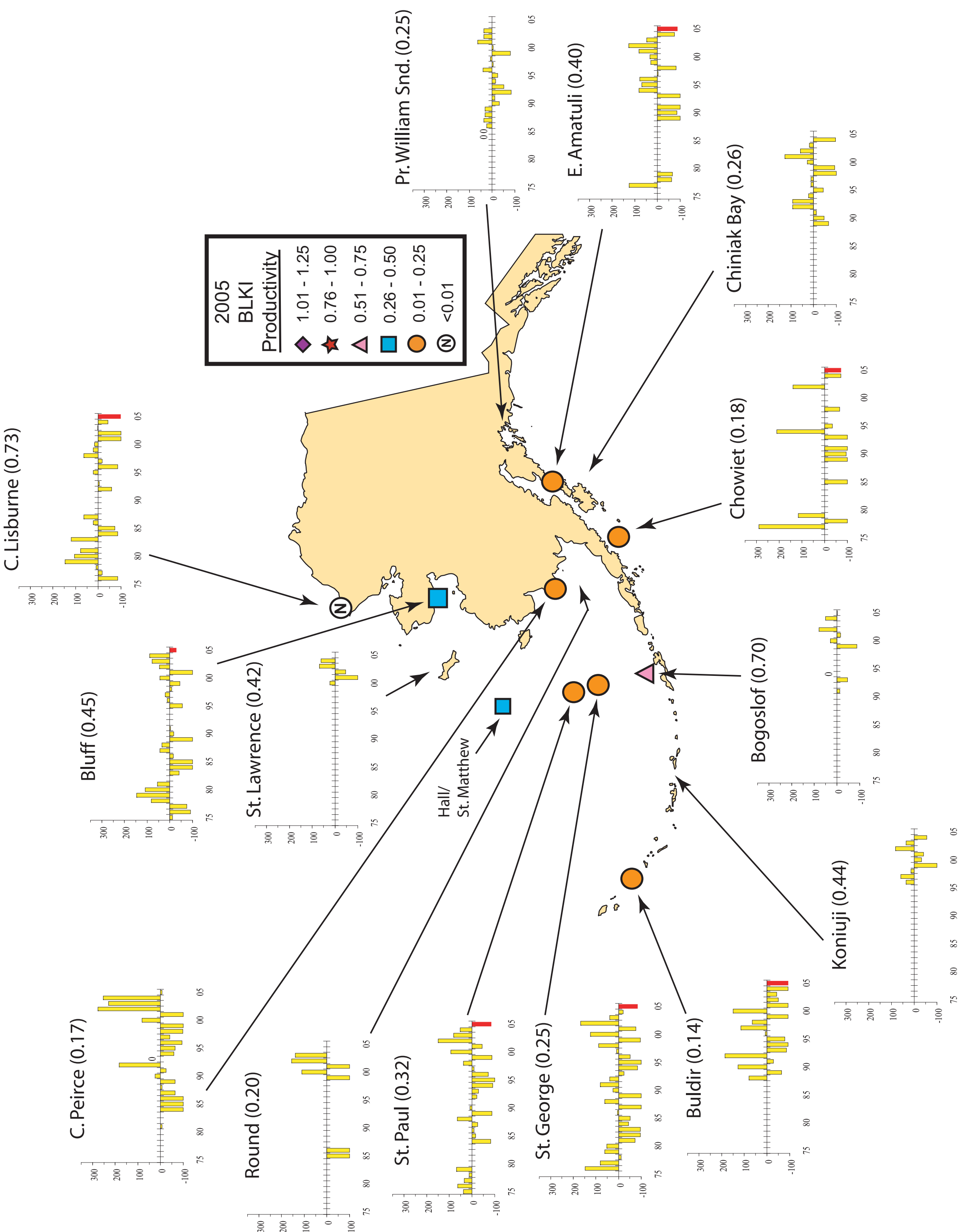


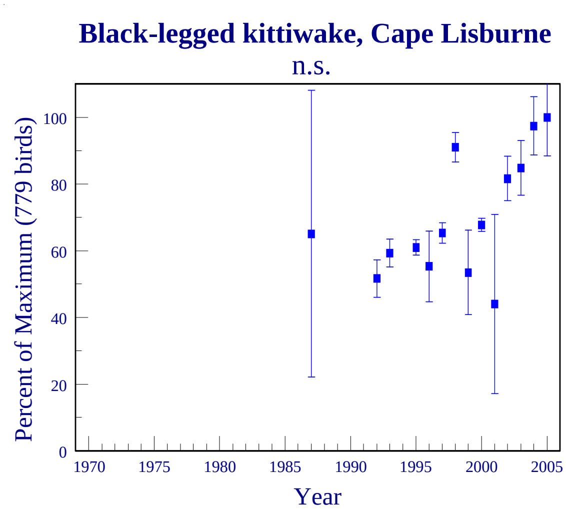
Figure 19. Productivity of black-legged kittiwakes (chicks fledged/nest) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

Table 13. Reproductive performance of black-legged kittiwakes at Alaskan sites monitored in 2005.

Site	Chicks Fledged[a]/Nest	No. of Plots	Long-term Average	Reference
C. Lisburne	<0.01[b]	2 (170)[c]	0.73 (23)[c]	D. Roseneau Unpubl. Data
Bluff	0.32[b]	5 (120)	0.45 (26)	Murphy 2005
Hall I	0.39[b]	7 (82)	N/A[d]	Renner and Sowls 2005
St. Matthew I.	0.44[b]	1 (75)	N/A	Renner and Sowls 2005
St. Paul I.	0.05	18 (543)	0.32 (25)	Wright et al. 2007
St. George I.	0.04	9 (161)	0.25 (29)	Thomson 2007
Cape Peirce	0.16	17 (300)	0.17 (22)	R. MacDonald Unpubl. Data
Buldir I.	0.01	9 (412)	0.14 (17)	Andersen and Barrett 2006
Bogoslof I.	0.69[b]	3 (77)	0.70 (8)	Renner and Williams 2005
Chowiet I.	0.05	2 (62)	0.18 (14)	Helm and Zeman 2007
E. Amatuli I.	0.05	11 (274)	0.40 (18)	A. Kettle Unpubl. Data

[a]Total chicks fledged/Total nests.
[b]Short visit.
[c]Sample size in parentheses represents the number of nests used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.
[d]Not applicable or not reported.



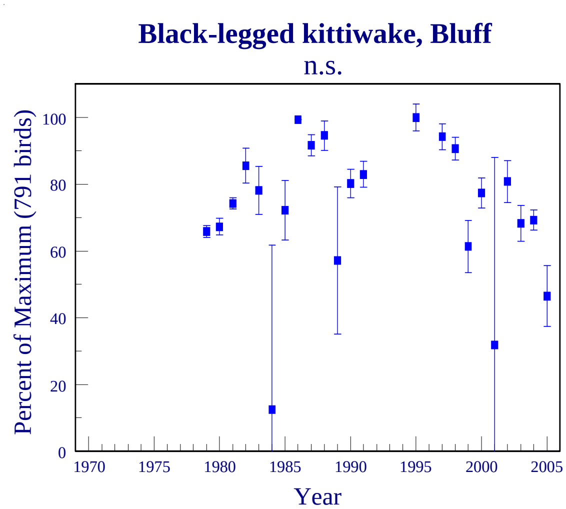


Figure 20. Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

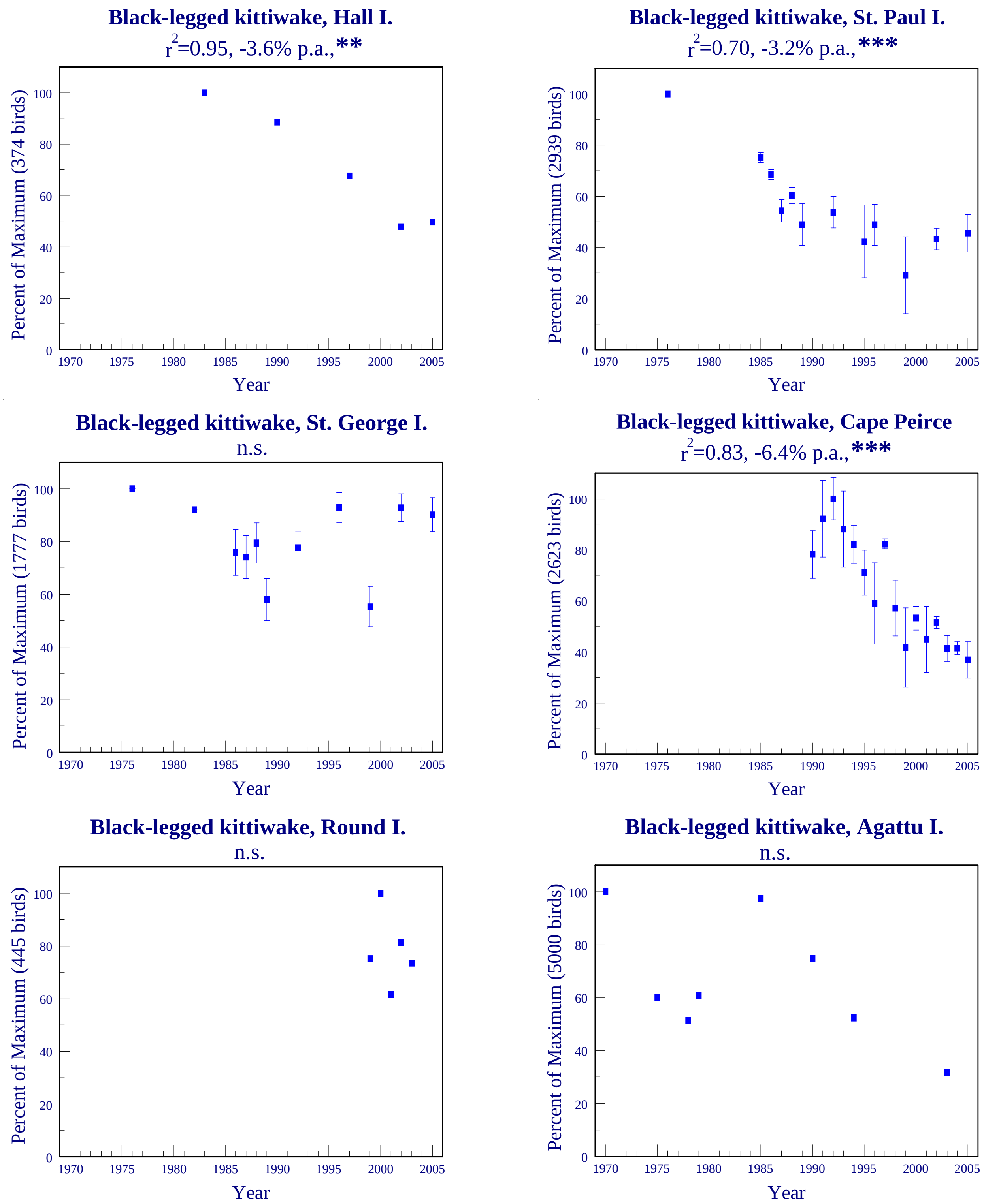


Figure 20 (continued). Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

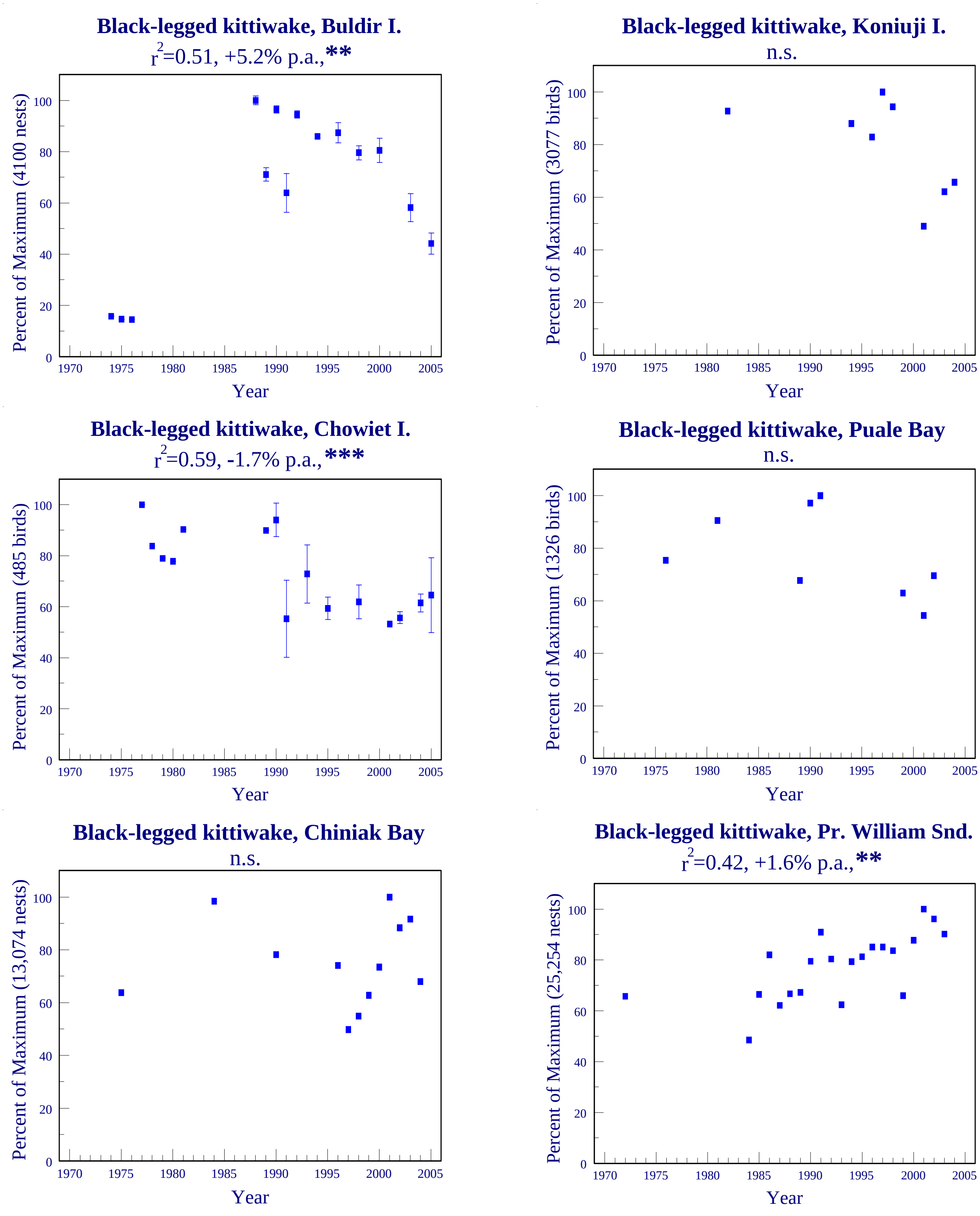


Figure 20 (continued). Trends in populations of black-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

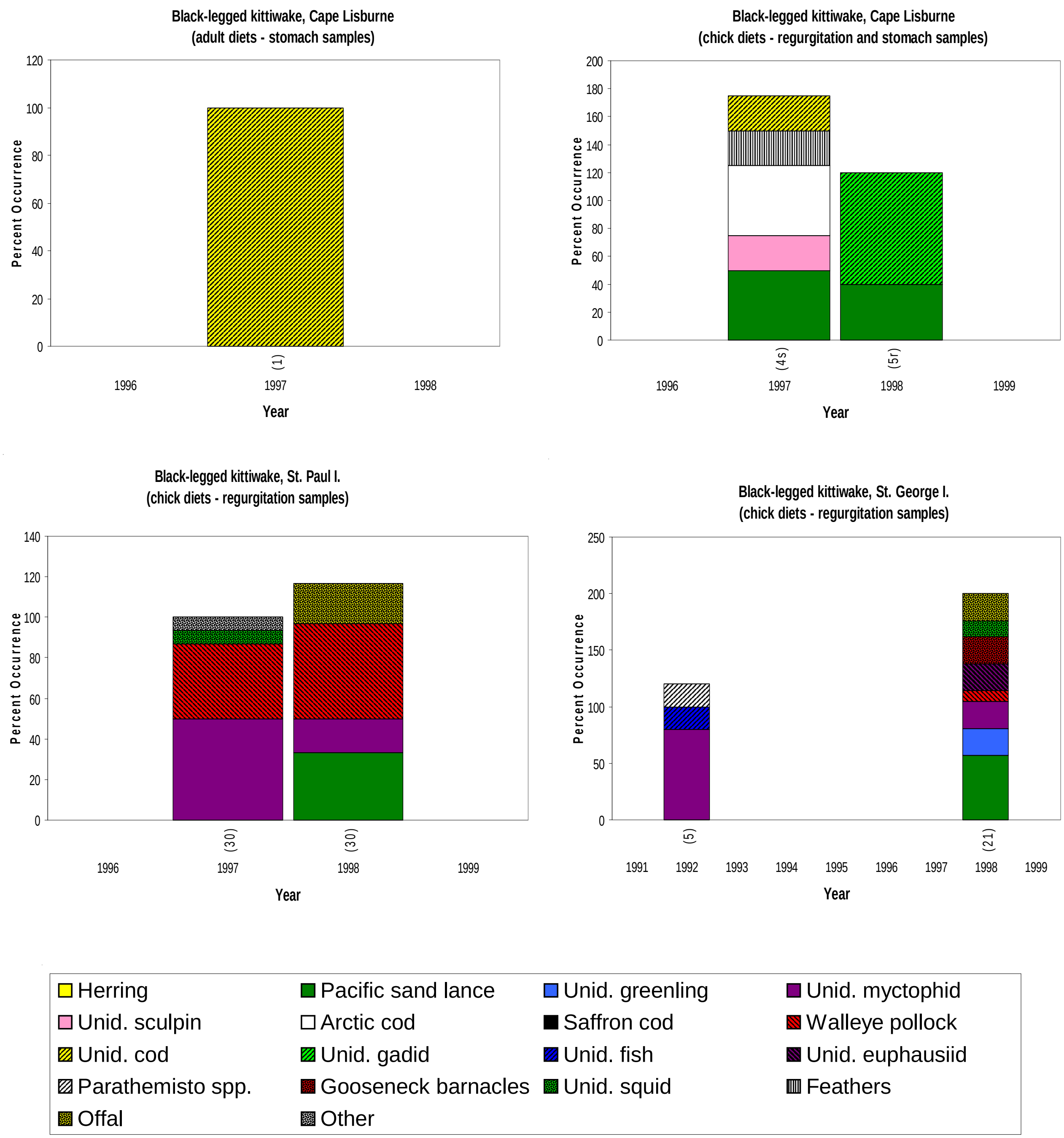


Figure 21. Diets of black-legged kittiwakes at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

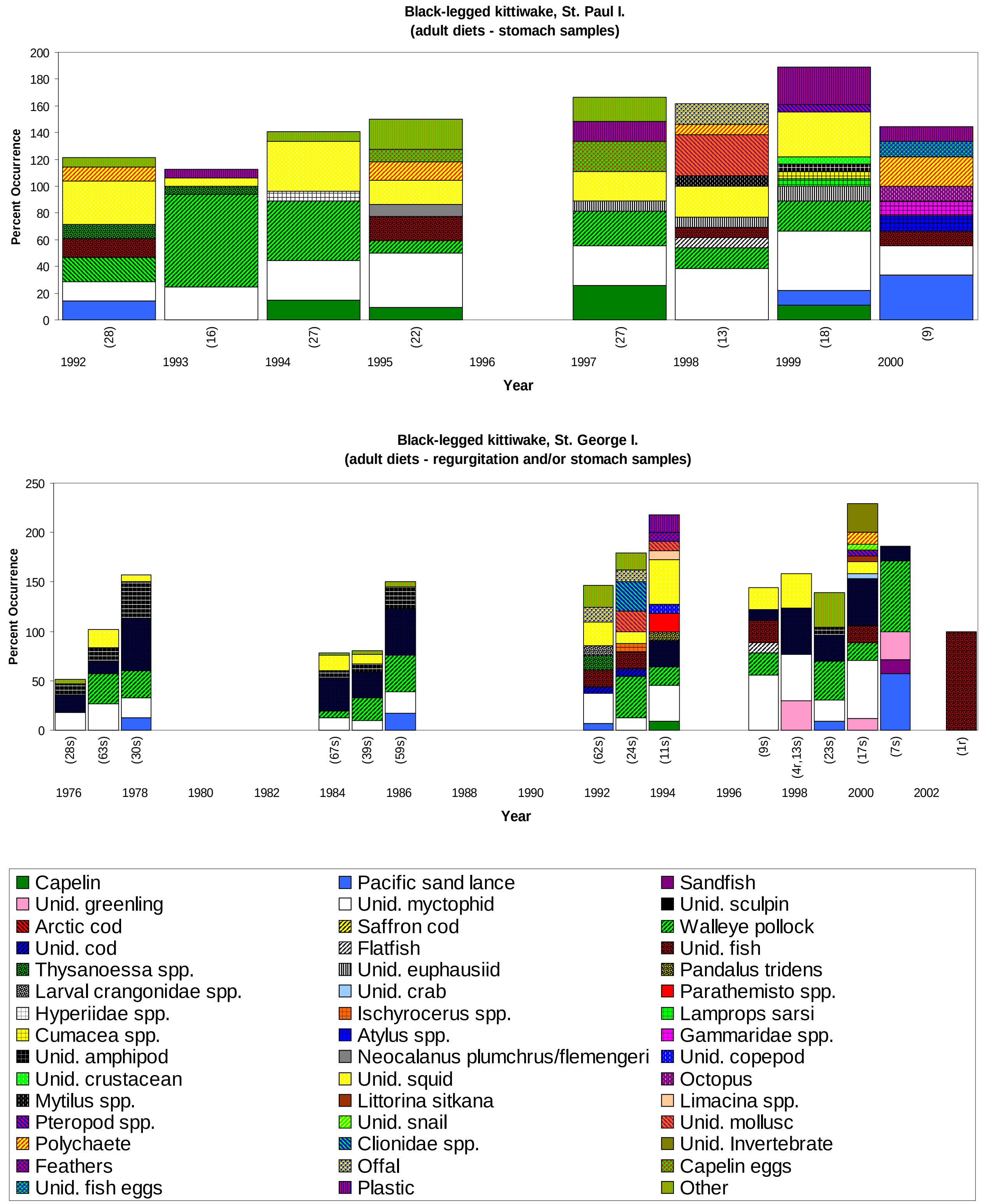


Figure 21 (continued). Diets of black-legged kittiwakes at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

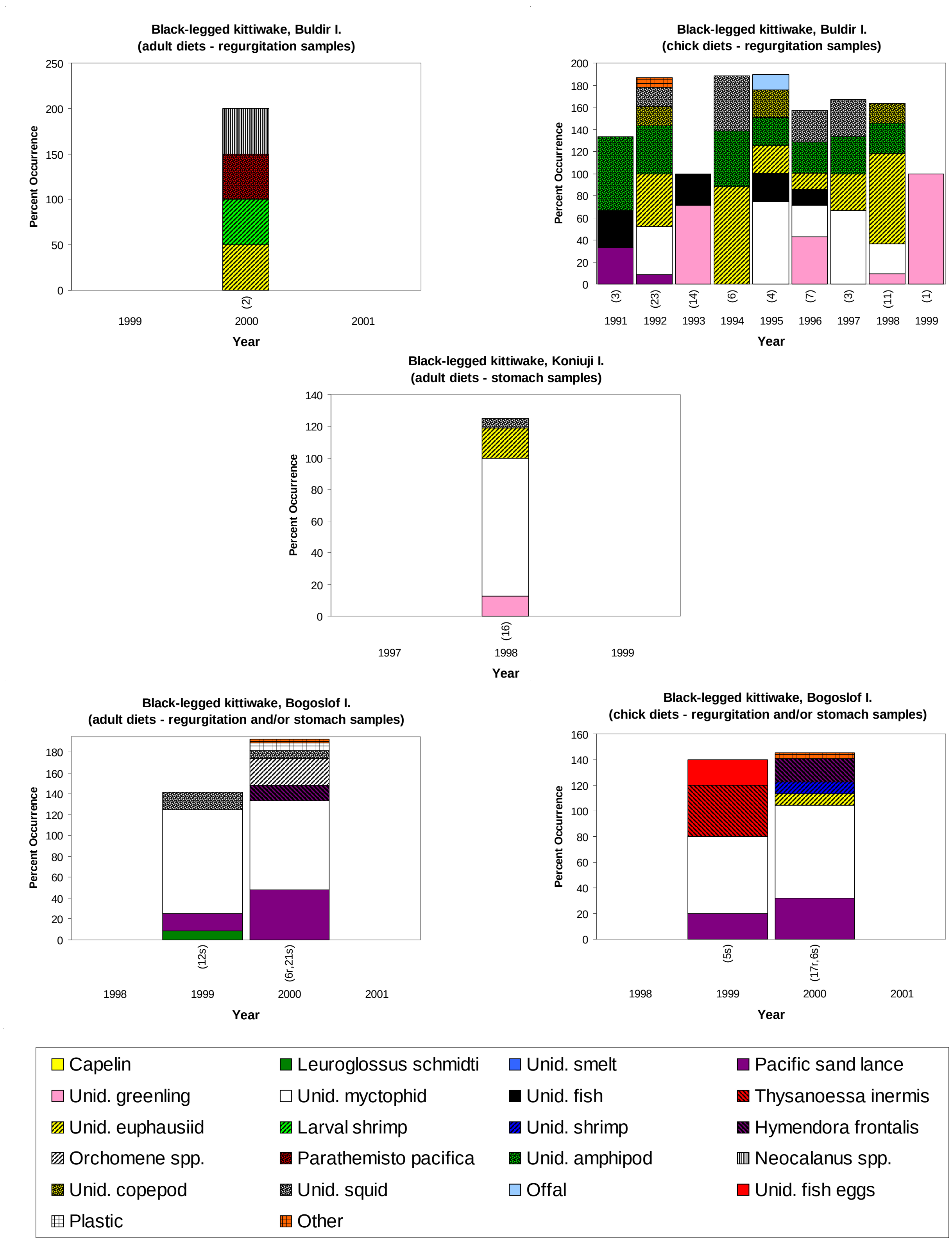


Figure 21 (continued). Diets of black-legged kittiwakes at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

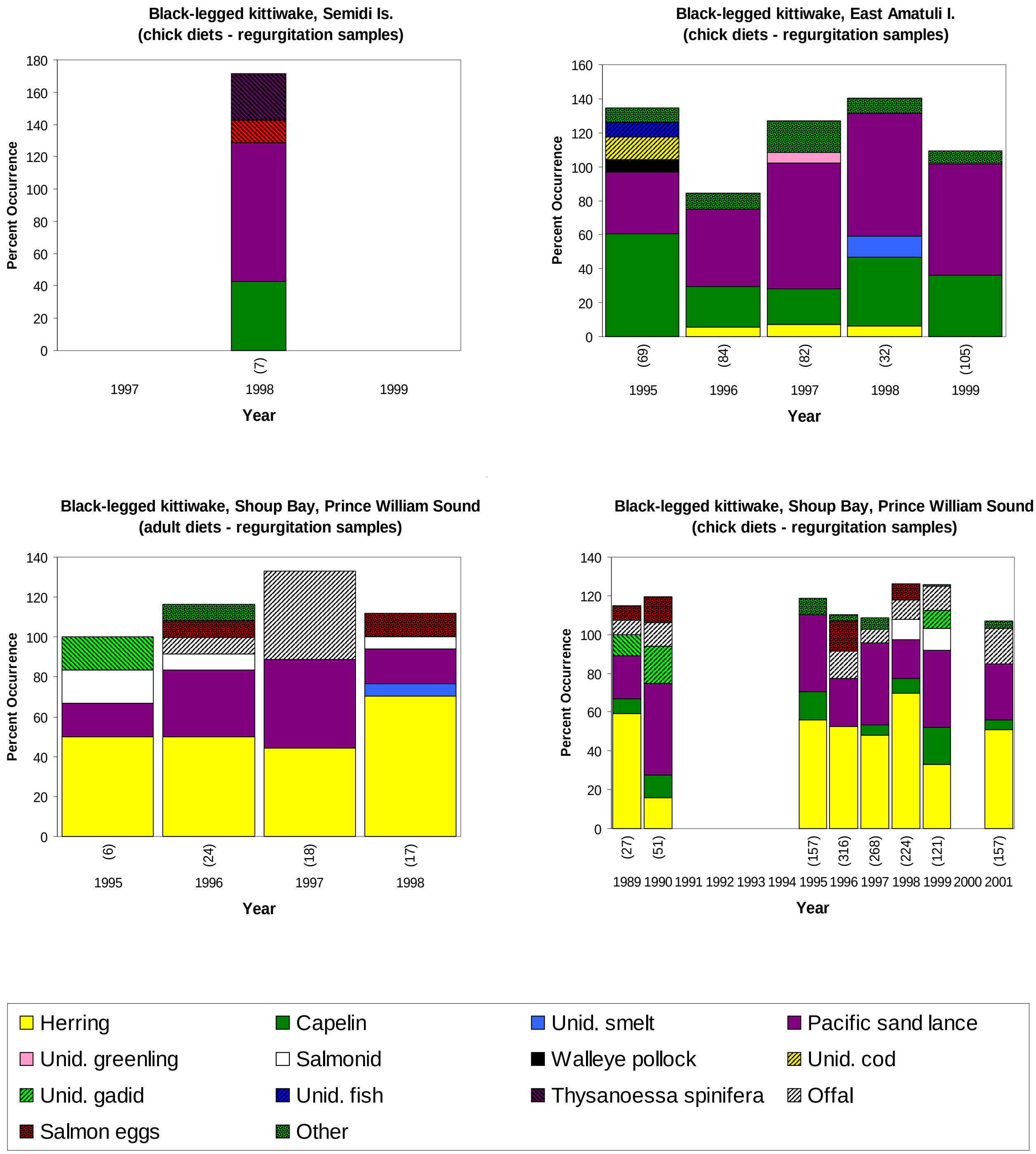


Figure 21 (continued). Diets of black-legged kittiwakes at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

Red-legged kittiwake (*Rissa brevirostris*)

Breeding chronology.–Hatch date was about average at St. George Island and late at Buldir Island in 2005 (Table 14, Fig. 22). No red-legged kittiwake eggs hatched at St. Paul Island in 2005.

Table 14. Hatching chronology of red-legged kittiwakes at Alaskan sites monitored in 2005.

Site	Mean	Long-term Average	Reference
St. Paul I.	NH[a]	22 Jul[c] (19)[b]	Wright et al. 2007
St. George I.	16 Jul (31)[b]	18 Jul[c] (23)	Thomson 2007
Buldir I.	27 Jul (3)	11 Jul[c] (16)	Andersen and Barrett 2006

[a]None hatched.
[b]Sample size in parentheses represents the number of nest sites used to calculate the mean hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[c]Mean of annual means.

Productivity.–In 2005, red-legged kittiwakes experienced below average productivity at all monitored sites (Table 15, Fig. 23).

Table 15. Reproductive performance of red-legged kittiwakes at Alaskan sites monitored in 2005.

Site	Chicks Fledged[a]/Nest	No. of Plots	Long-term Average	Reference
St. Paul I.	0.00	4 (54)[b]	0.25 (25)[b]	Wright et al. 2007
St. George I.	0.02	14 (408)	0.26 (29)	Thomson 2007
Buldir I.	0.06	N/A[c] (36)	0.16 (17)	Andersen and Barrett 2006
Bogoslof I.	0.13[d]	2 (8)	0.43 (8)	Renner and Williams 2005

[a]Total chicks fledged/Total nests.
[b]Sample size in parentheses represents the number of nests used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.
[c]Not applicable or not reported.
[d]Short visit.

Populations.–Red-legged kittiwakes declined significantly at St. Paul Island (-3.3% per annum). This species exhibited a positive population trend at Buldir Island (+2.7% per annum), and no trend at St. George Island (Fig. 24).

Diet.–Diets collected from St. Paul Island included walleye pollock and other fish as well as squid and offal (Fig. 25). Red-legged kittiwakes from St. George and Buldir islands primarily ate myctophids with lesser amounts of other small fish and invertebrates. Diets from Bogoslof Island also were dominated by myctophids.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

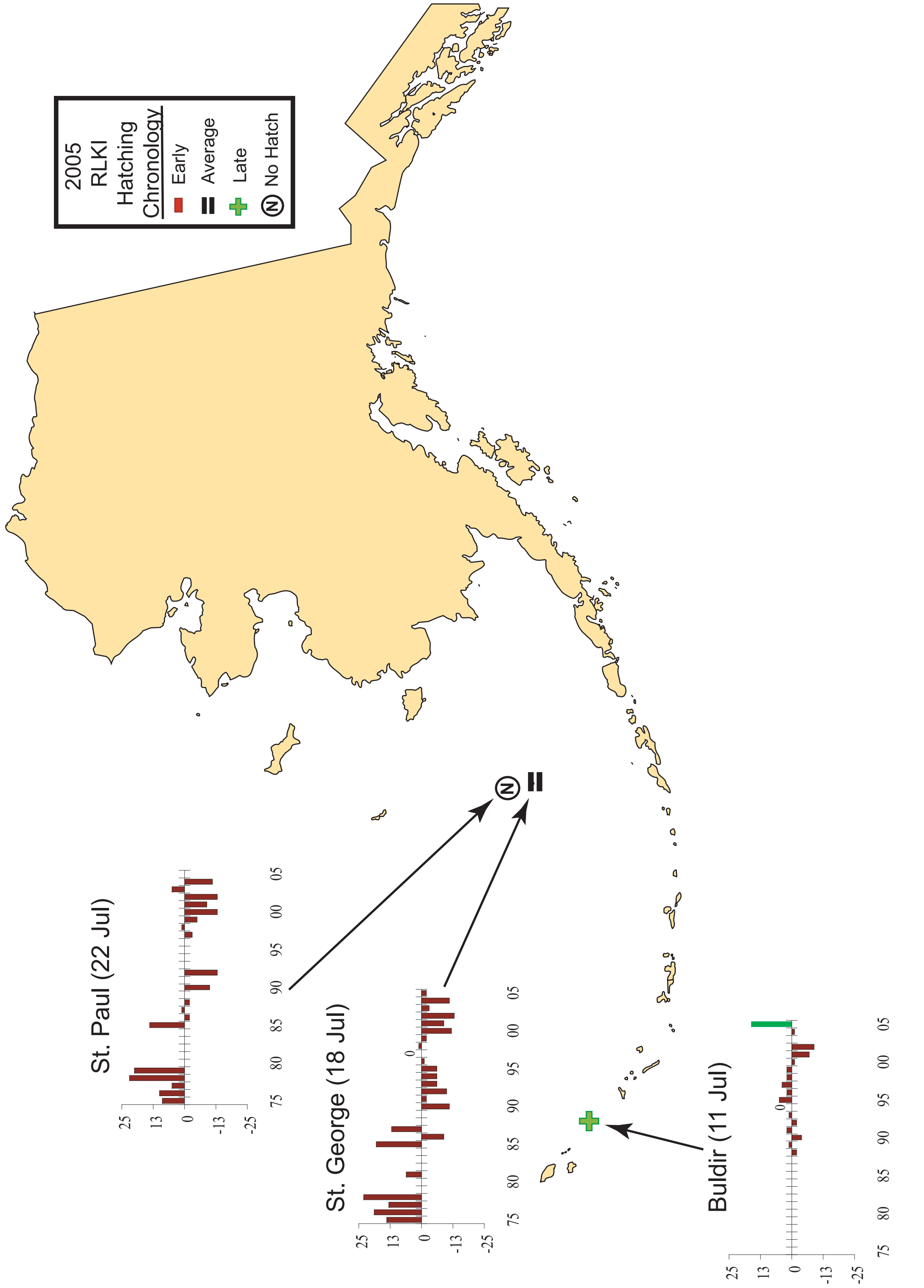


Figure 22. Hatching chronology of red-legged kittiwakes at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

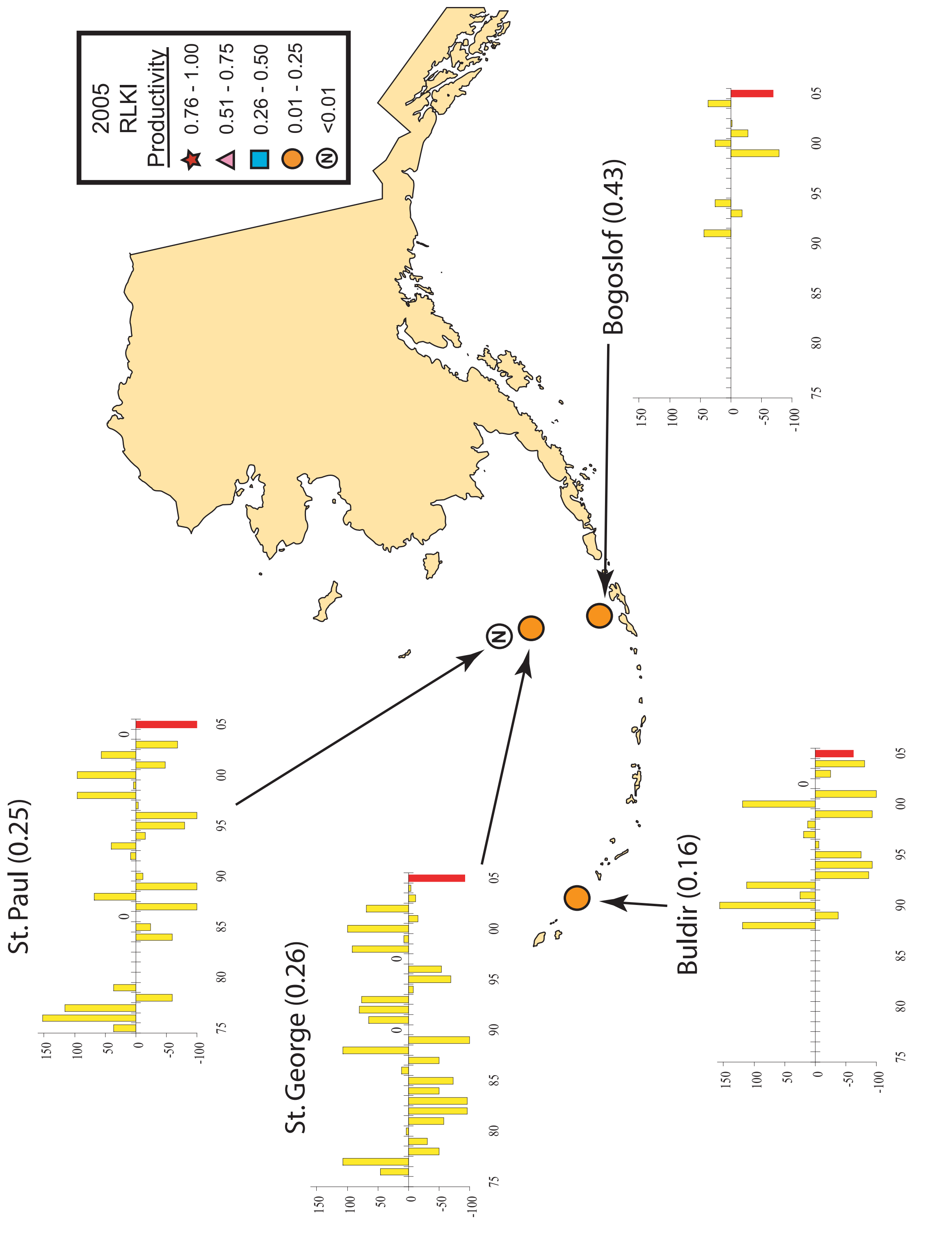


Figure 23. Productivity of red-legged kittiwakes (chicks fledged/nest) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

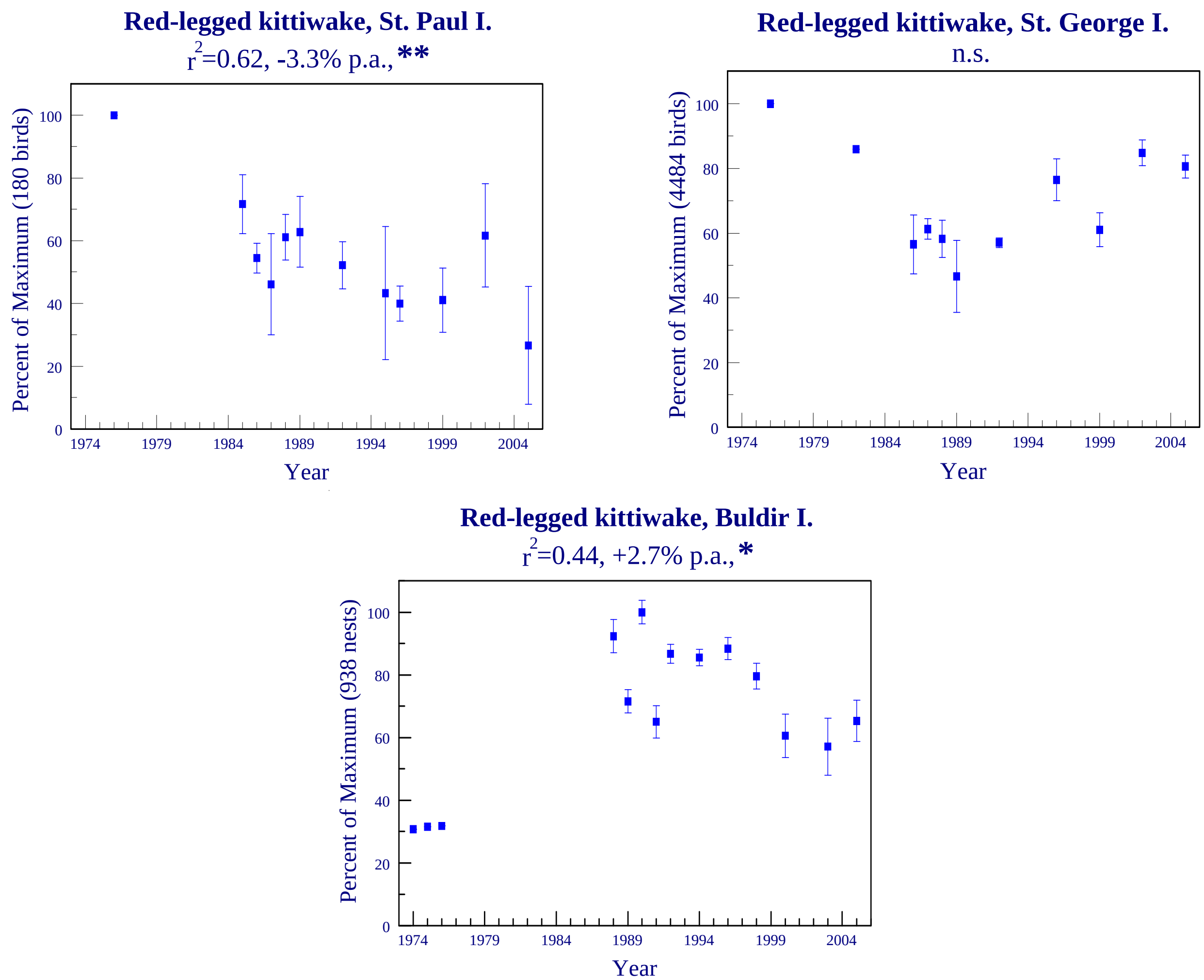


Figure 24. Trends in populations of red-legged kittiwakes at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

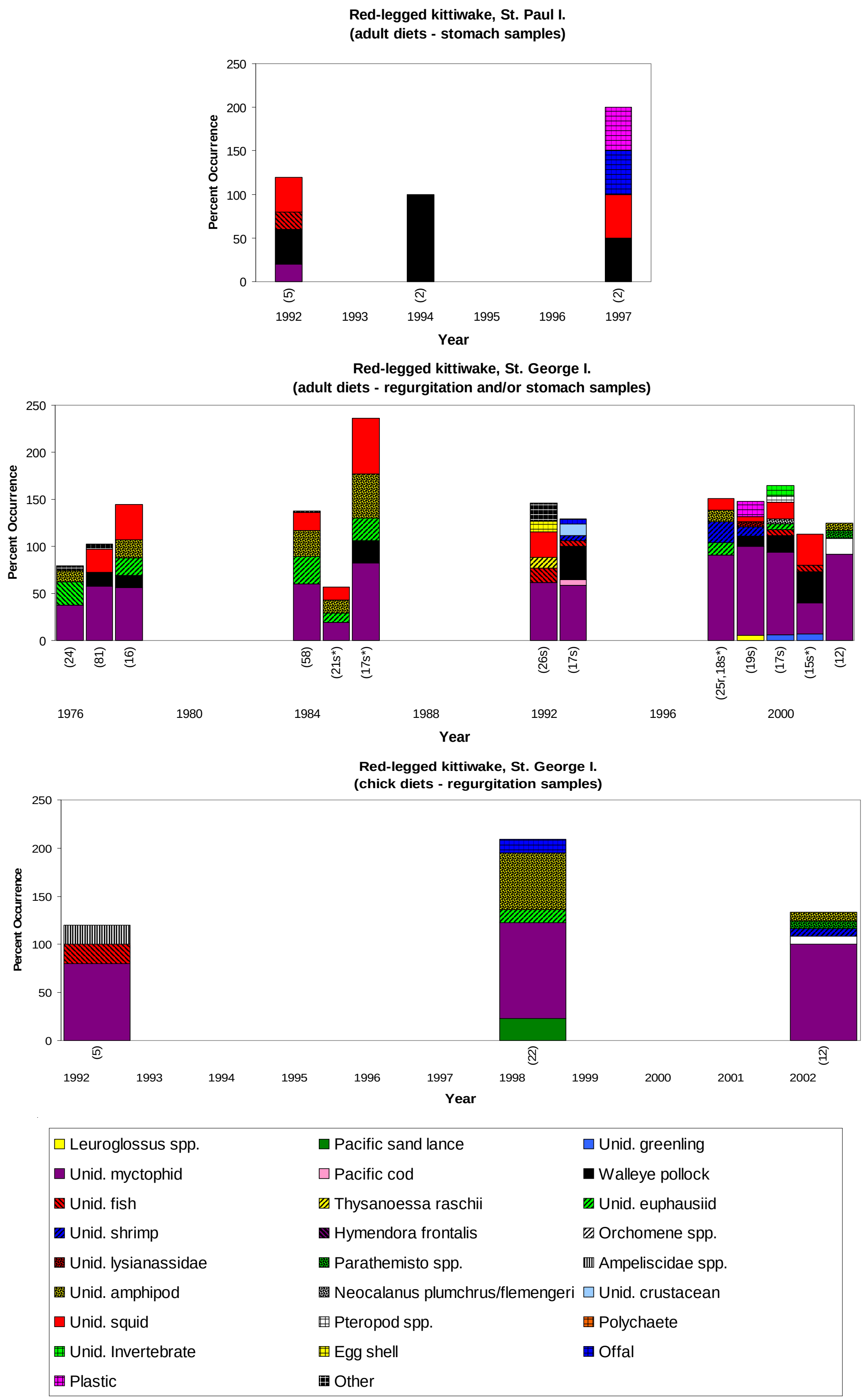


Figure 25. Diets of red-legged kittiwakes at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

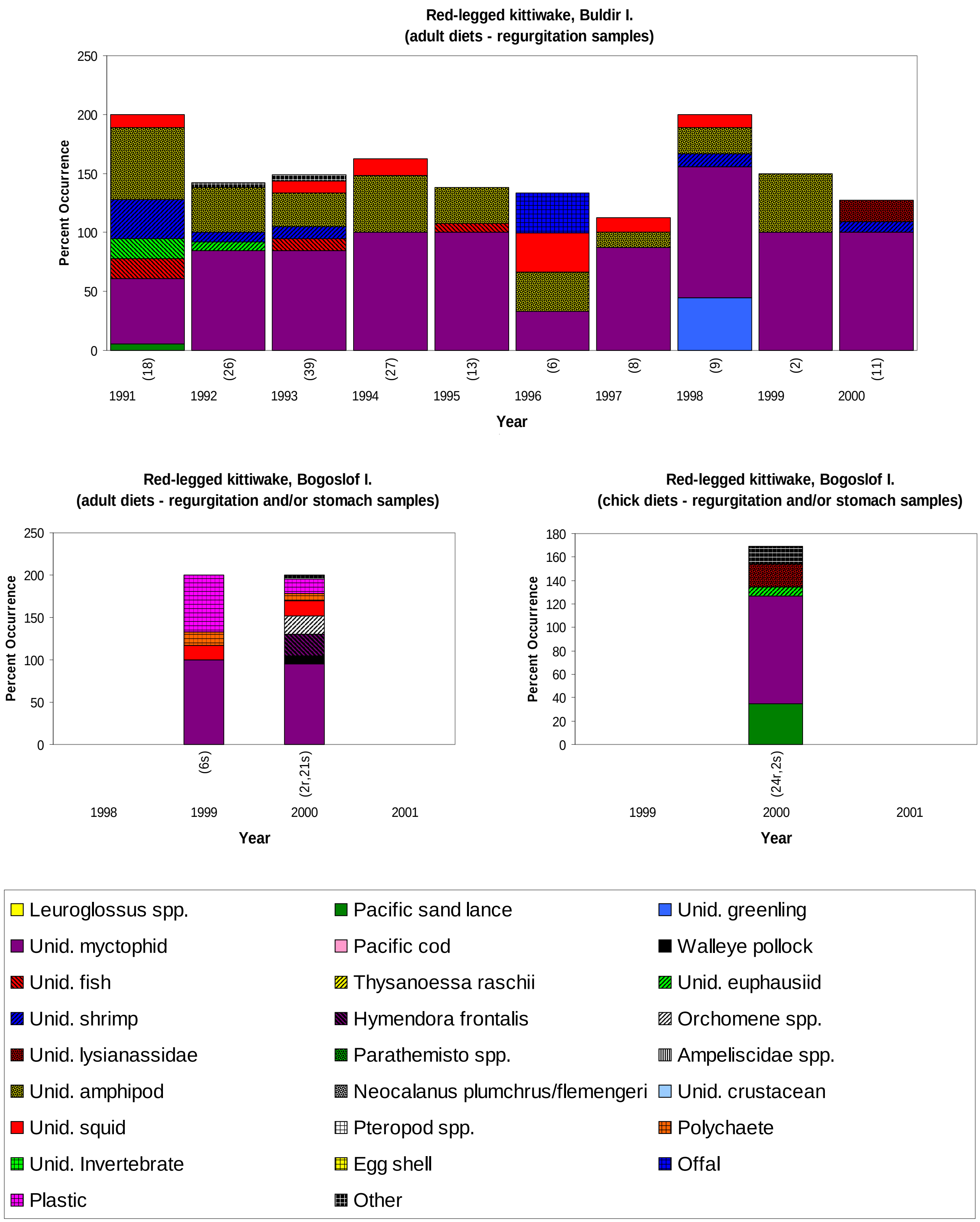


Figure 25 (continued). Diets of red-legged kittiwakes at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

Common murre (*Uria aalge*)

Breeding chronology.–Timing of common murre nesting events in 2005 was earlier than average at Bluff, Cape Peirce and Chowiet Island, later than average at the Pribilofs and East Amatuli Island, and about average at St. Lazaria Island (Table 16, Fig. 26). No eggs were laid by this species at Aiktak Island and only one egg hatched at Buldir Island in 2005 .

Table 16. Hatching chronology of common murres at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Bluff	22 Jul (N/A[a])[b]	—	26 Jul[c] (28)[b]	Murphy 2005
St. Paul I.	—	18 Aug (10)	5 Aug[d] (20)	Wright et al. 2007
St. George I.	—	9 Aug (25)	4 Aug[d] (21)	Thomson 2007
Cape Peirce	—	14 Jul (99)	22 Jul[d] (16)	R. MacDonald Unpubl. Data
Buldir I.	—[e]	—[e]	17 Jul[d] (7)	Andersen and Barrett 2006
Aiktak I.	—[f]	—[f]	12 Aug[d] (5)	Helm and Zeman 2006
Chowiet I.	14 Jul (165)	13 Jul (165)	23 Jul[d] (10)	Helm and Zeman 2007
E. Amatuli I.	13 Aug (136)	13 Aug (136)	8 Aug[d] (12)	A. Kettle Unpubl. Data
St. Lazaria I.	—	10 Aug (34)	12 Aug[d] (11)	L. Slater Unpubl. Data

[a]Not applicable or not reported.
[b]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[c]Mean of annual medians.
[d]Mean of annual means.
[e]Only one egg hatched at Buldir I. in 2005.
[f]No eggs were laid at Aiktak I. in 2005.

Productivity.–Common murre productivity was average or below average at all of the sites monitored in 2005 (Table 17, Fig. 27). For the second year in a row, no eggs were laid by this species at Aiktak Island.

Populations.–At sites where counts of murres are made from the water, it is difficult to accurately assign every individual to a species. As a result, common and thick-billed murres often are combined at these colonies for population trend analysis. We found significant negative trends in common murre numbers at St. Paul Island and Cape Peirce (-3.2% and -3.9% per annum, respectively, Fig. 28). No trends were discernible for this species at any other monitored site.Where murres were not identified to species, we found significant negative trends at Aiktak and St. Lazaria islands (-6.3% and-3.0% per annum, respectively). Significant positive trends were evident for murres at Cape Lisburne (+4.1% per annum), and Agattu, Koniuji and Chowiet islands (+2.7%, +10.6% and +1.1% per annum, respectively).

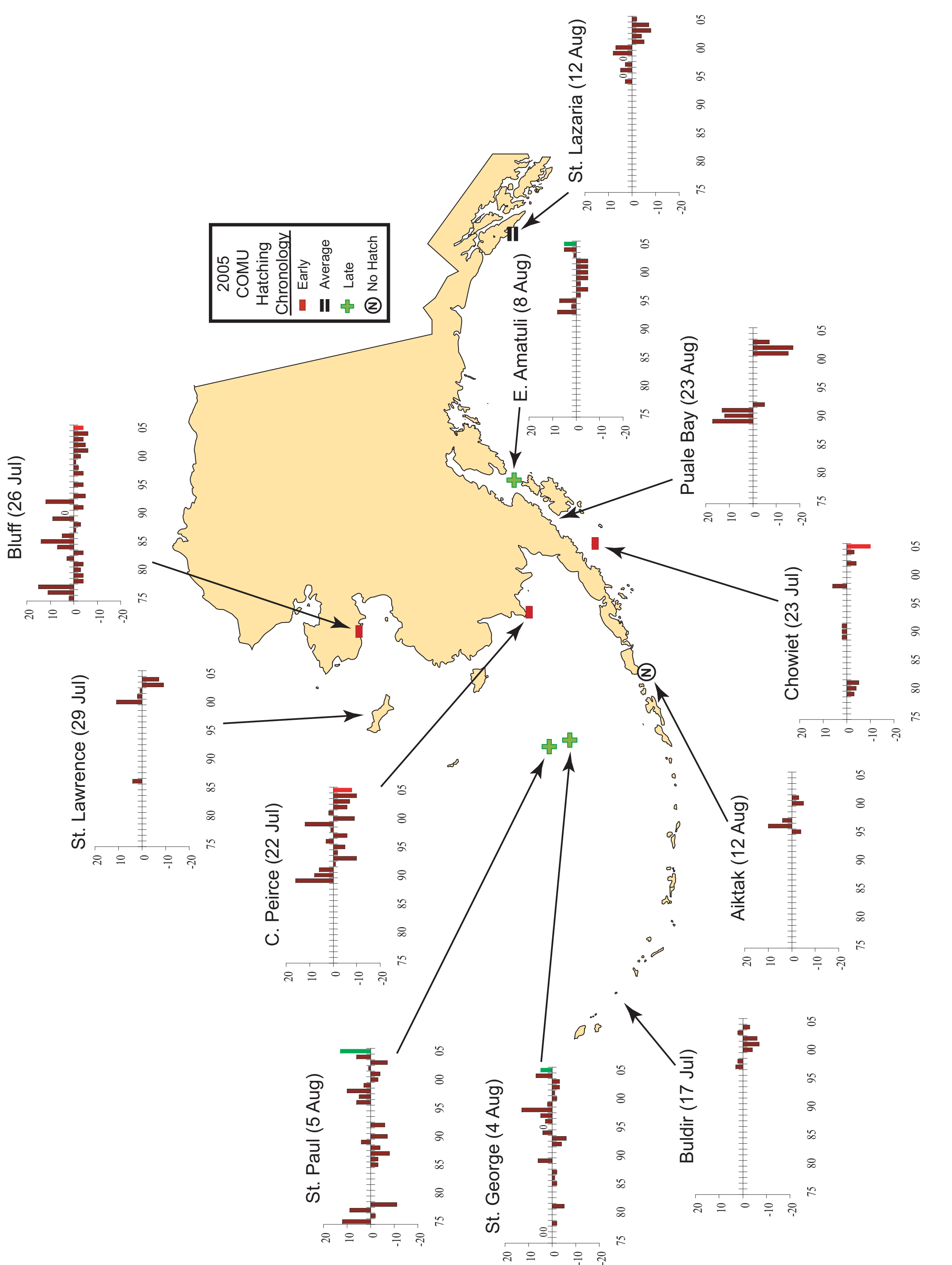


Figure 26. Hatching chronology of common murres at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

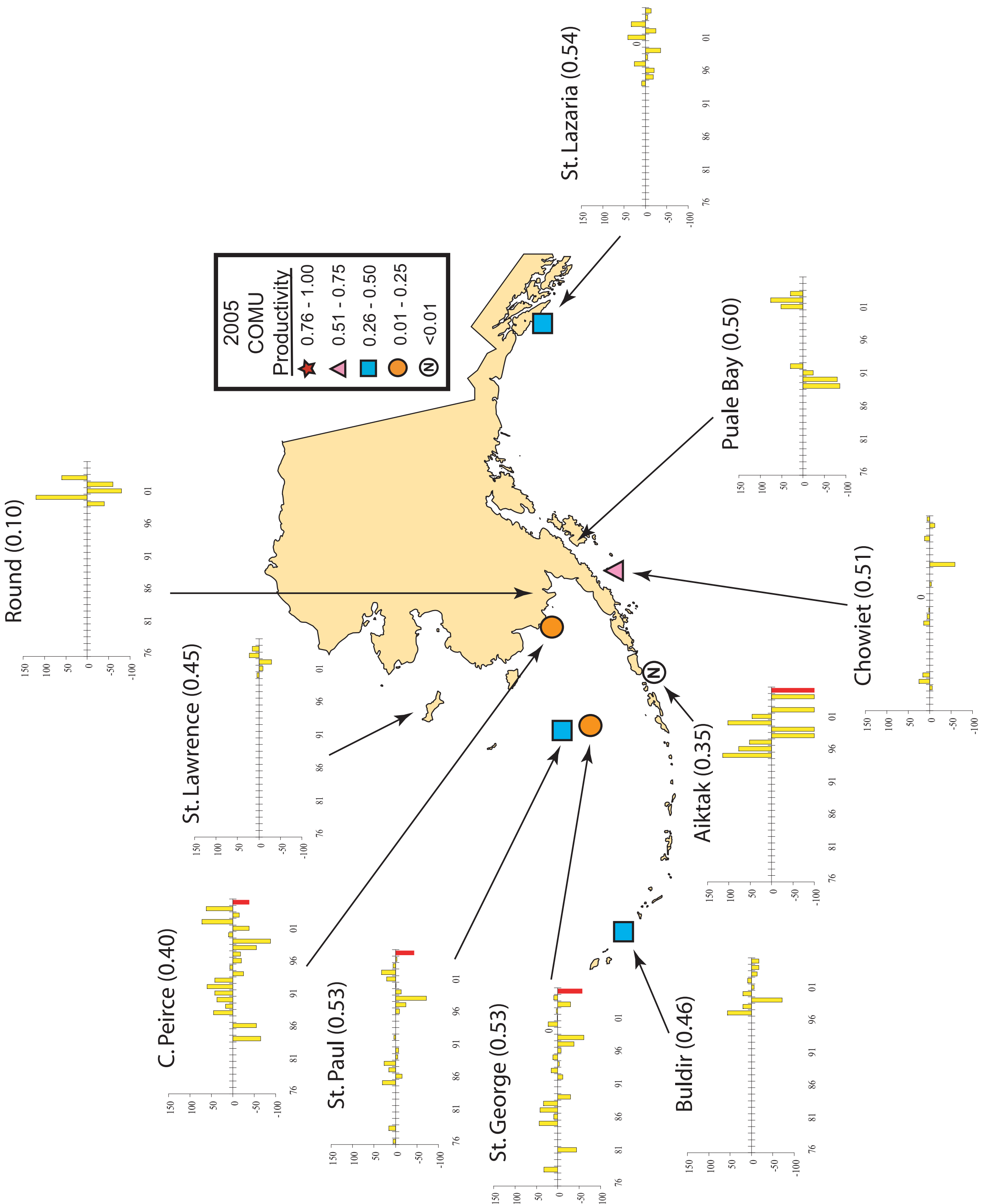


Figure 27. Productivity of common murres (chicks fledged/nest site) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

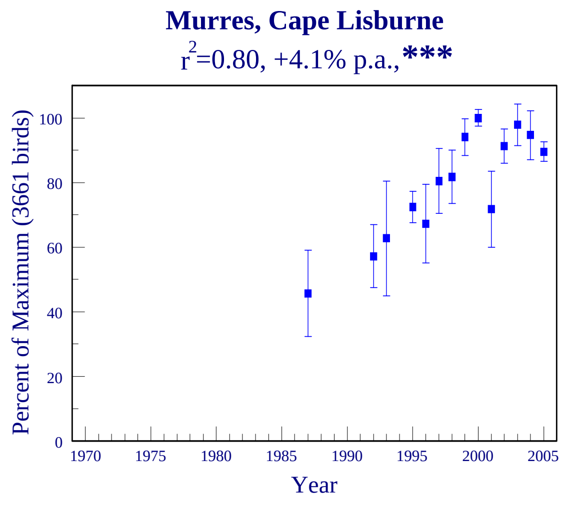
Table 17. Reproductive performance of common murres at Alaskan sites monitored in 2005.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	Long-term Average	Reference
St. Paul I.	0.30	4 (54)[b]	0.53 (18)[b]	Wright et al. 2007
St. George I.	0.23	6 (84)	0.53 (20)	Thomson 2007
Cape Peirce	0.25	16 (288)	0.40 (19)	R. MacDonald Unpubl. Data
Buldir I.	0.38	N/A[c] (8)	0.46 (8)	Andersen and Barrett 2006
Aiktak I.	0.00	N/A (0)	0.35 (9)	Helm and Zeman 2006
Chowiet I.	0.54	10 (284)	0.51 (11)	Helm and Zeman 2007
St. Lazaria I.	0.47	N/A (58)	0.54 (11)	L. Slater Unpubl. Data

[a]Since murres do not build nests, nest sites were defined as sites where eggs were laid.
[b]Sample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.
[c]Not applicable or not reported.

Diet.–Diets collected from Cape Lisburne included a variety of small fish (Fig. 29). Common murres at St. George Island ate predominately walleye pollock and other small fish. Diets from Chowiet Island consisted primarily of capelin, sand lance and pollock. Murres from the Barren Islands ate predominately capelin. Samples from Buldir and Koniuji Islands contained primarily squid, pollock and herring. Bogoslof Island diets consisted primarily of polychaetes, sand lance and other fish. Common murres from Aiktak Island ate predominately sand lance and pollock.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.



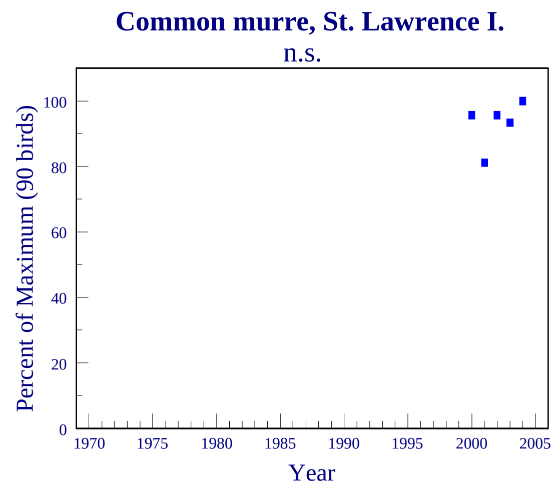


Figure 28. Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

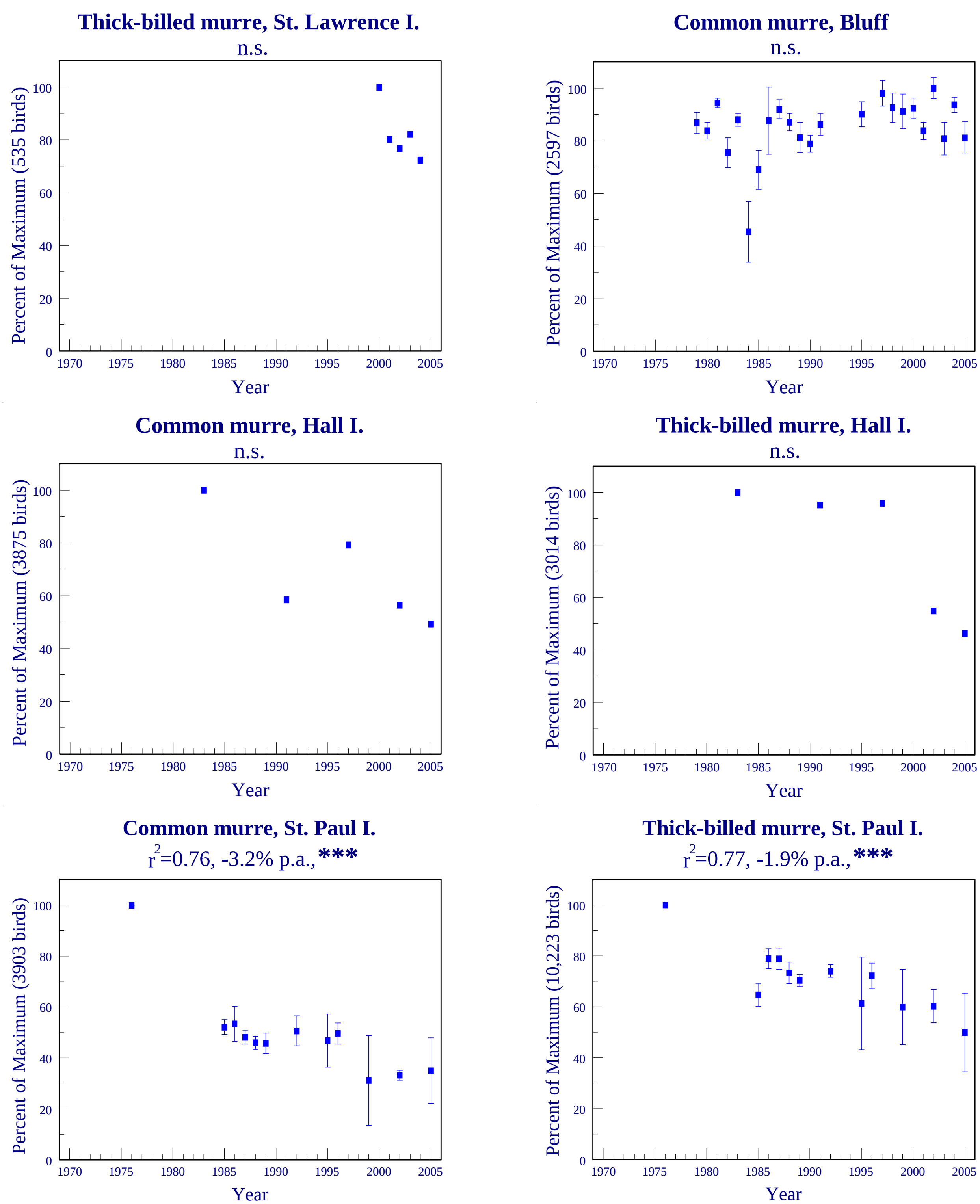


Figure 28 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

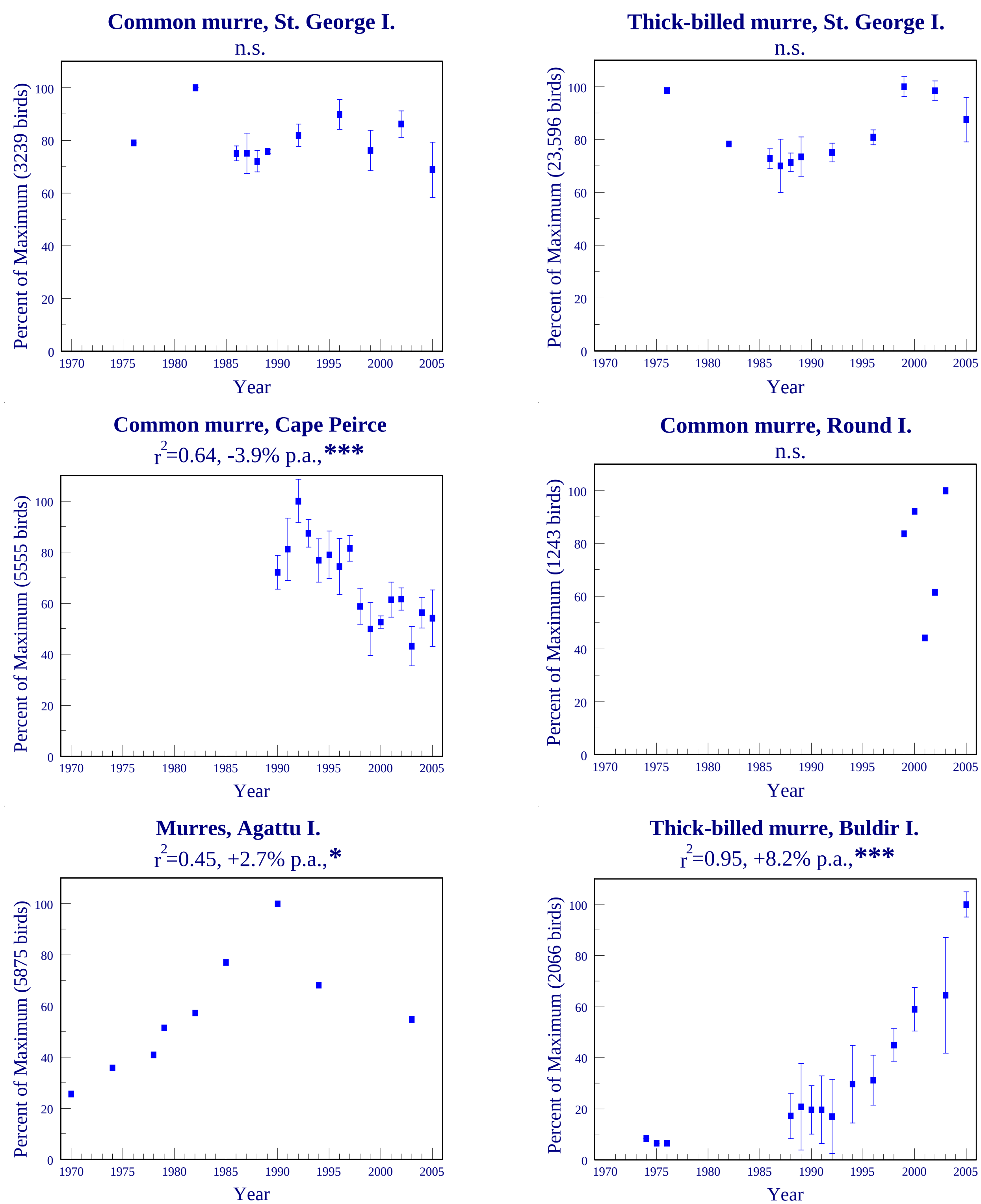


Figure 28 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

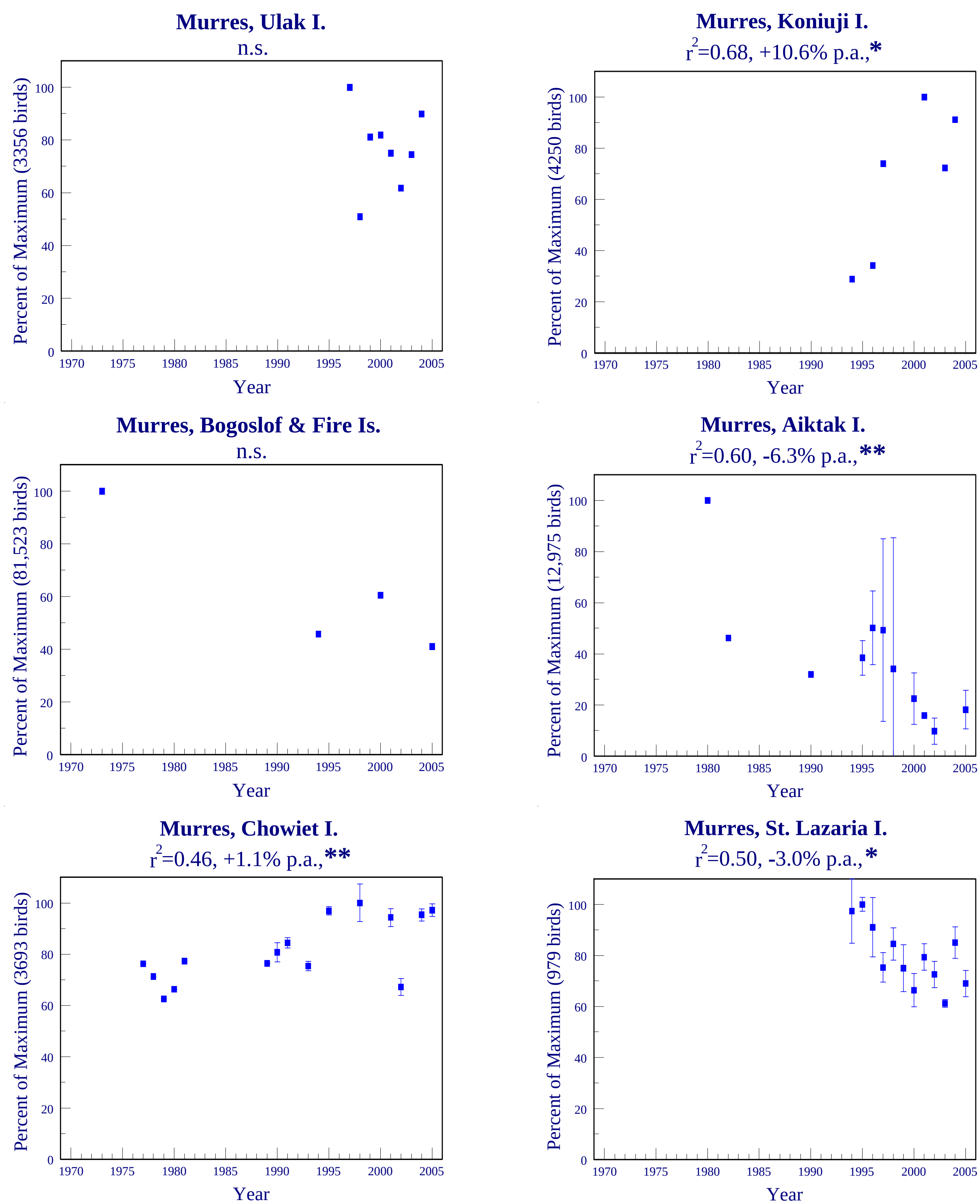


Figure 28 (continued). Trends in populations of murres at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

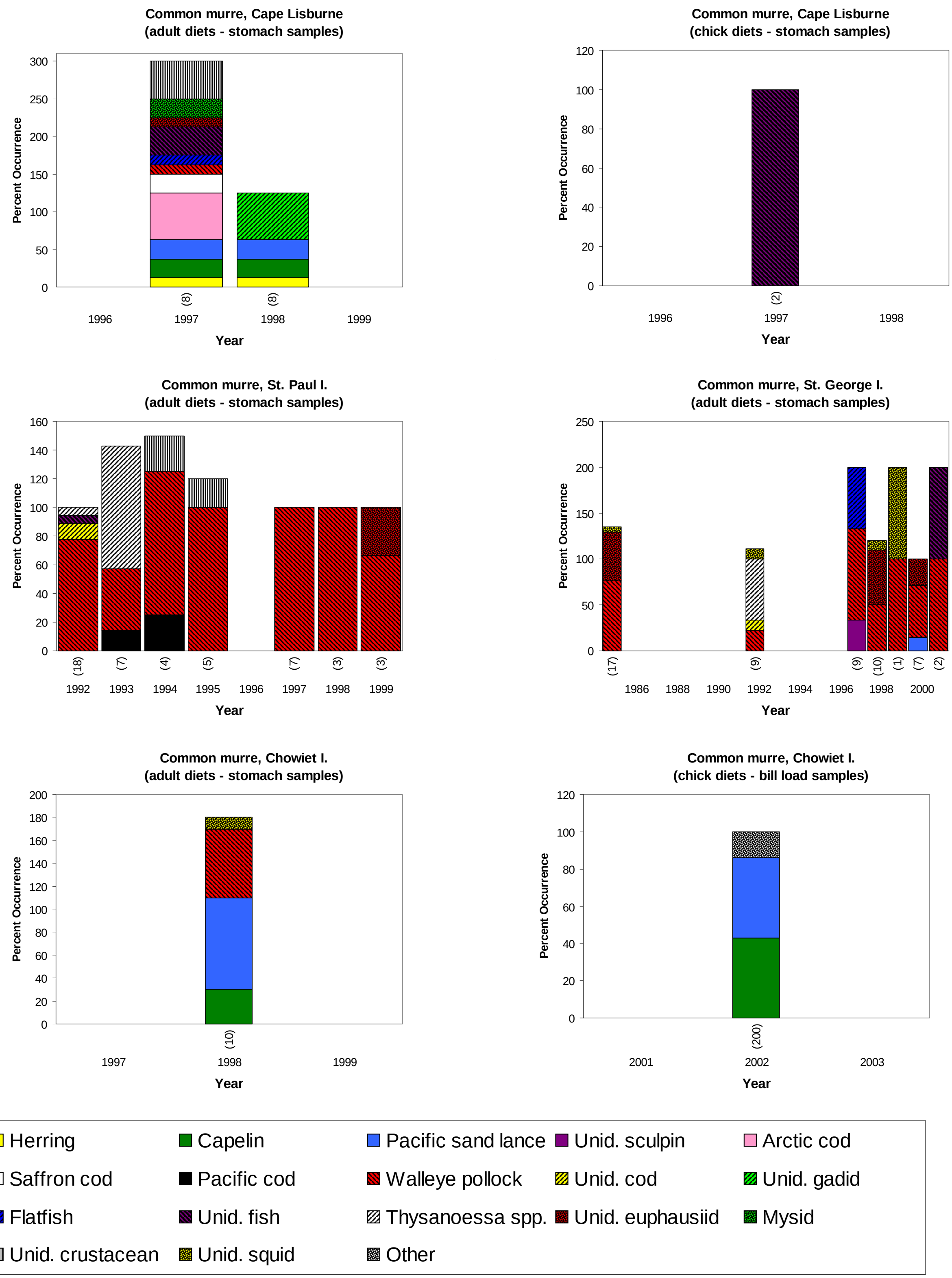


Figure 29. Diets of common murres at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

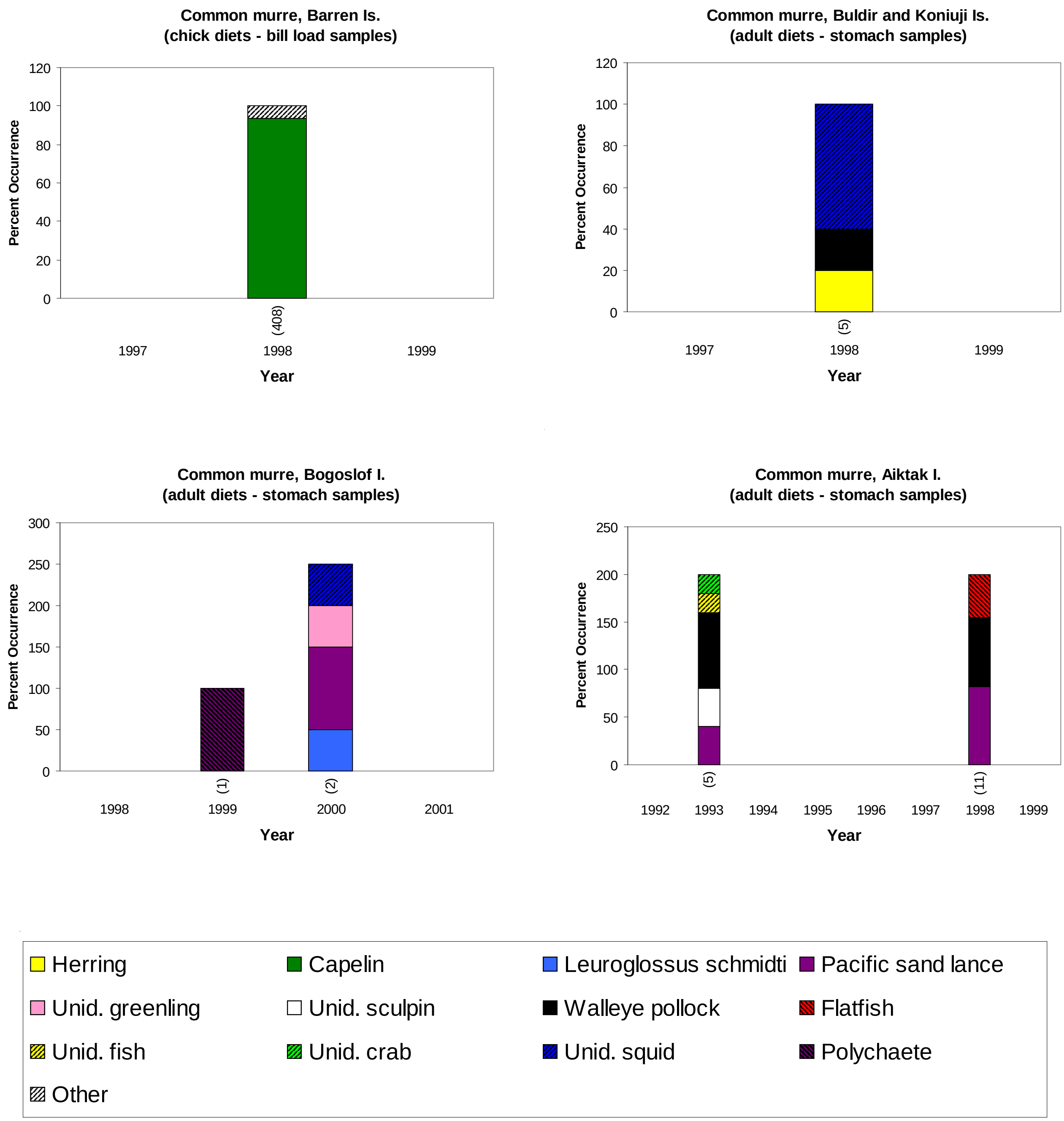


Figure 29 (continued). Diets of common murres at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

Thick-billed murre (*Uria lomvia*)

Breeding chronology.–In 2005, thick-billed murre chicks hatched later than average at the Pribilof Islands, were early at Chowiet Island, and about average at Buldir and St. Lazaria islands (Table 18, Fig. 30). No eggs were laid by this species at Aiktak Island in 2005.

Table 18. Hatching chronology of thick-billed murres at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
St. Paul I.	—	17 Aug (16)[a]	6 Aug[b] (20)[a]	Wright et al. 2007
St. George I	—	4 Aug (207)	31 Jul[b] (23)	Thomson 2007
Buldir I.	20 Jul (75)	20 Jul (75)	17 Jul[b] (17)	Andersen and Barrett 2006
Aiktak I.	—[c]	—[c]	8 Aug[b] (5)	Helm and Zeman 2006
Chowiet I.	14 Jul (75)	16 Jul (75)	20 Jul[b] (9)	Helm and Zeman 2007
St. Lazaria I.	—	10 Aug (15)	9 Aug[b] (11)	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.
[c]No eggs were laid at Aiktak I. in 2005.

Productivity.–Thick-billed murre rates of success in 2005 were average or below average at all monitored colonies (Table 19, Fig. 31). For the second year in a row, no eggs were laid by this species at Aiktak Island..

Table 19. Reproductive performance of thick-billed murres at Alaskan sites monitored in 2005.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	Long-term Average	Reference
St. Paul I.	0.33	7 (177)[b]	0.47 (19)[b]	Wright et al. 2007
St. George I.	0.31	21 (590)	0.53 (23)	Thomson 2007
Buldir I.	0.59	9 (286)	0.66 (17)	Andersen and Barrett 2006
Aiktak I.	0.00	N/A[c]	0.30 (9)	Helm and Zeman 2006
Chowiet I.	0.39	7 (158)	0.42 (11)	Helm and Zeman 2007
St. Lazaria I.	0.35	N/A (34)	0.46 (11)	L. Slater Unpubl. Data

[a]Since murres do not build nests, nest sites were defined as sites where eggs were laid.
[b]Sample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.
[c]Not applicable or not reported.

Populations.–Thick-billed murres declined at St. Paul Island (-1.9% per annum) and increased at Buldir Island (+8.2% per annum, Fig. 28). No trends were evident for this species at other monitored colonies.

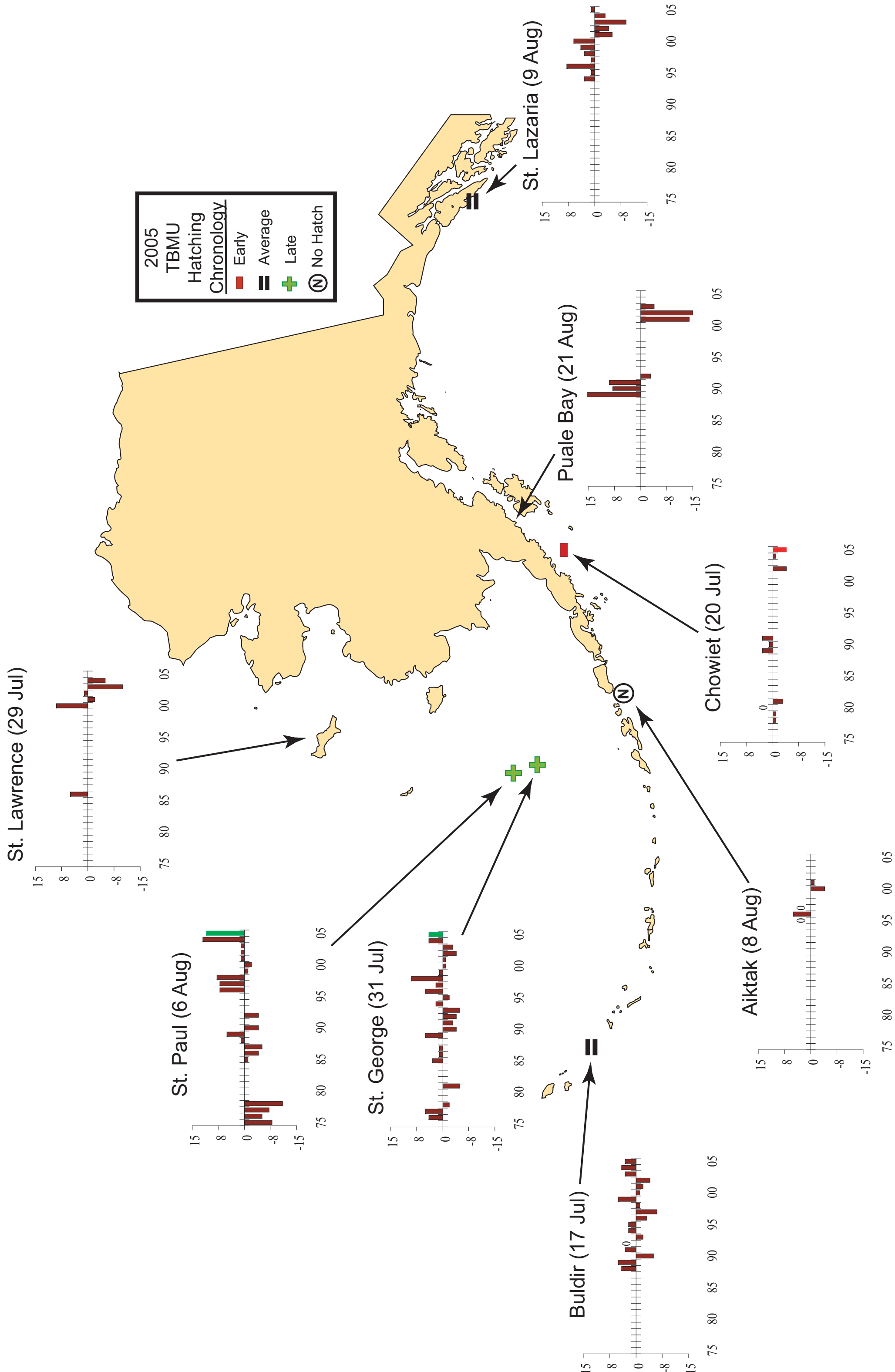


Figure 30. Hatching chronology of thick-billed murres at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

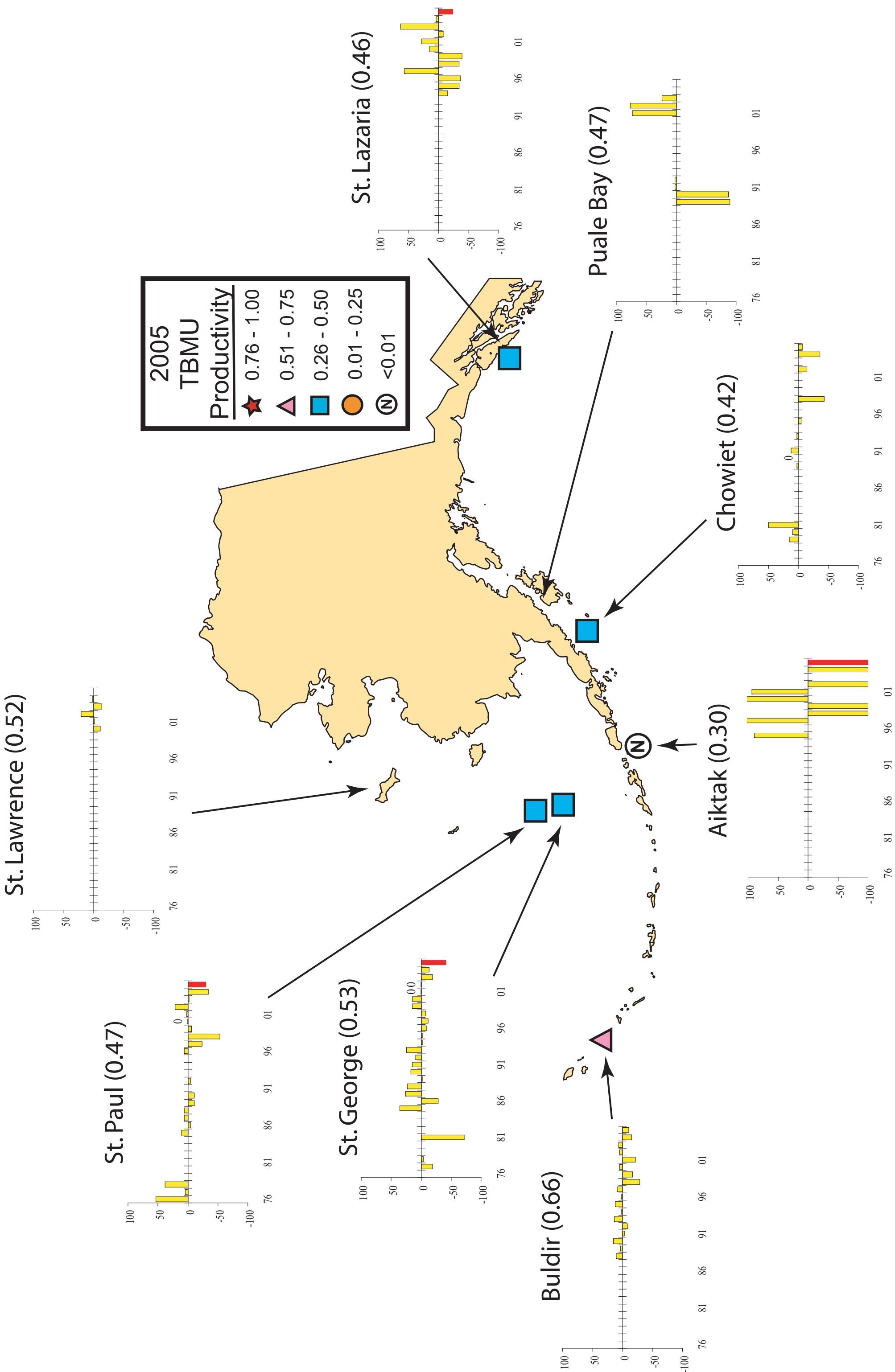


Figure 31. Productivity of thick-billed murres (chicks fledged/nest site) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

Diet.–Murres at Aiktak Island ate primarily walleye pollock (Fig. 32). Diet samples from Buldir Island included large numbers of squid, while samples from Bogoslof Island included both squid and small fish. Diets collected from Cape Lisburne included a wide variety of small fish and invertebrates. Diets from St. Paul Island consisted of predominately pollock, other small fish, small crustaceans and squid. Thick-billed murres from St. George Island ate primarily pollock, euphausiids and squid.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

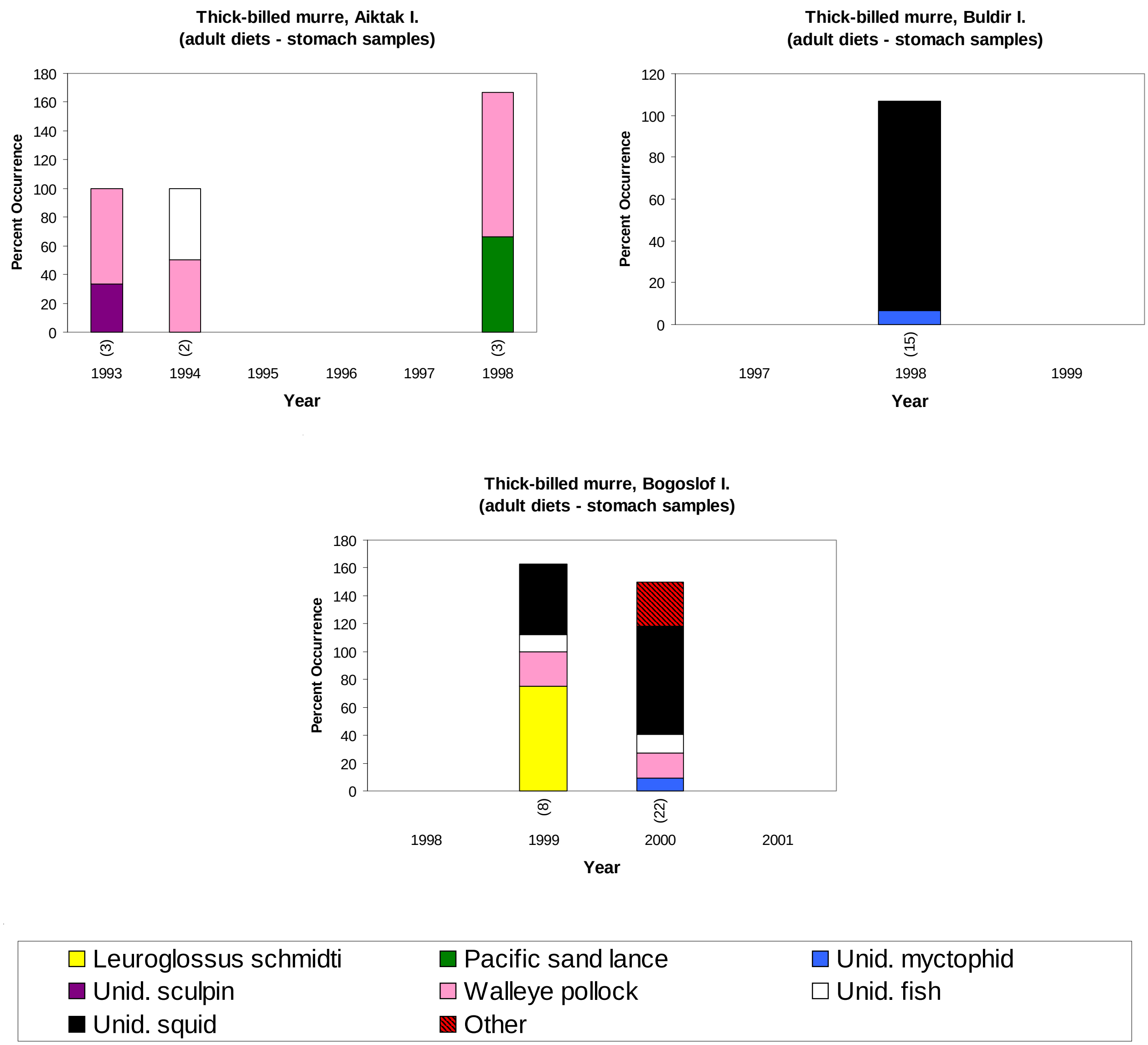


Figure 32. Diets of thick-billed murres at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

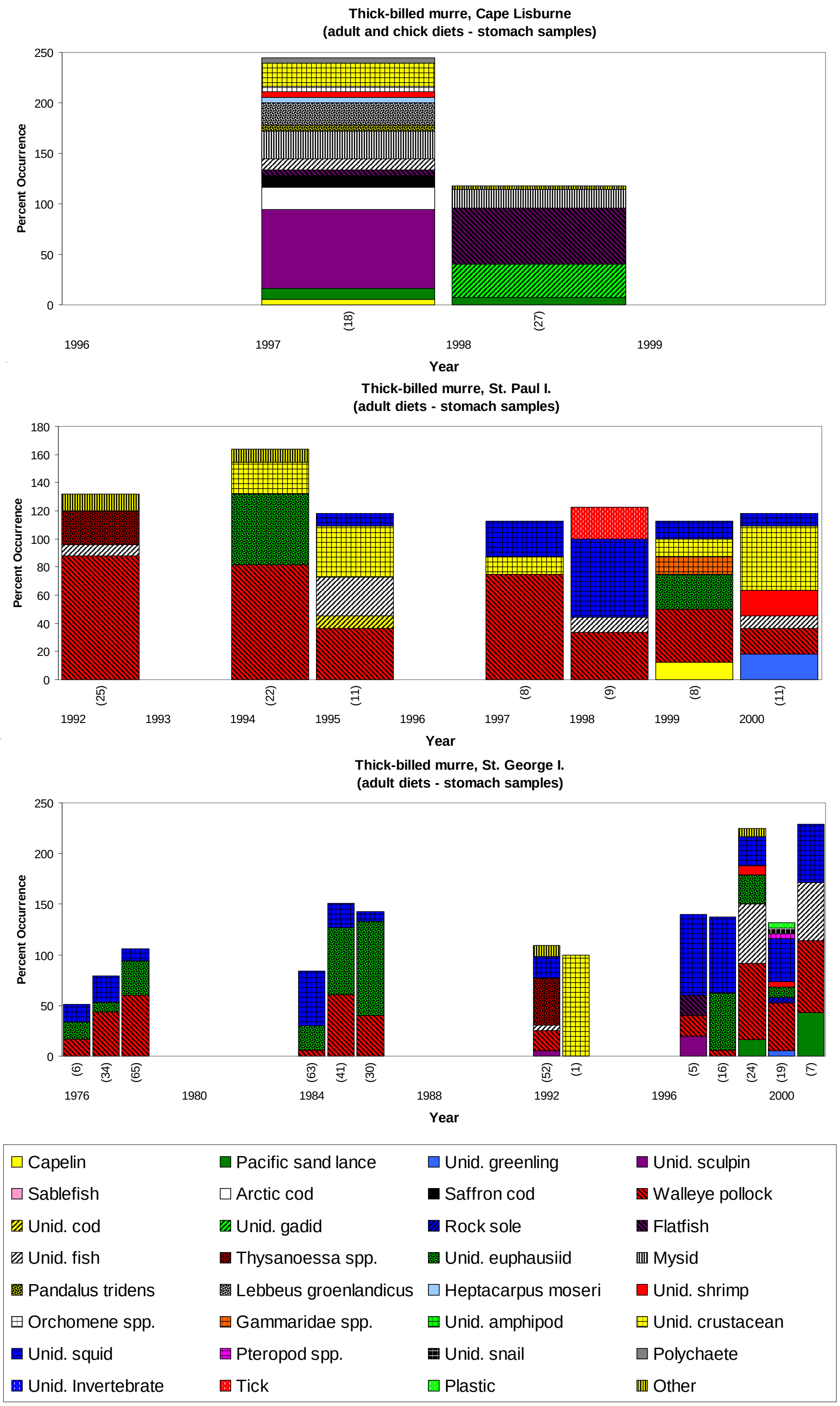


Figure 32 (continued). Diets of thick-billed murres at Cape Lisburne, and St. Paul and St. George islands. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

Pigeon guillemot (*Cepphus columba*)

Breeding chronology.–No data.

Productivity.–No data.

Populations.–We found a significant negative population trend for pigeon guillemots in Prince William Sound (-6.1% per annum), but not for populations at other sites (Fig. 33).

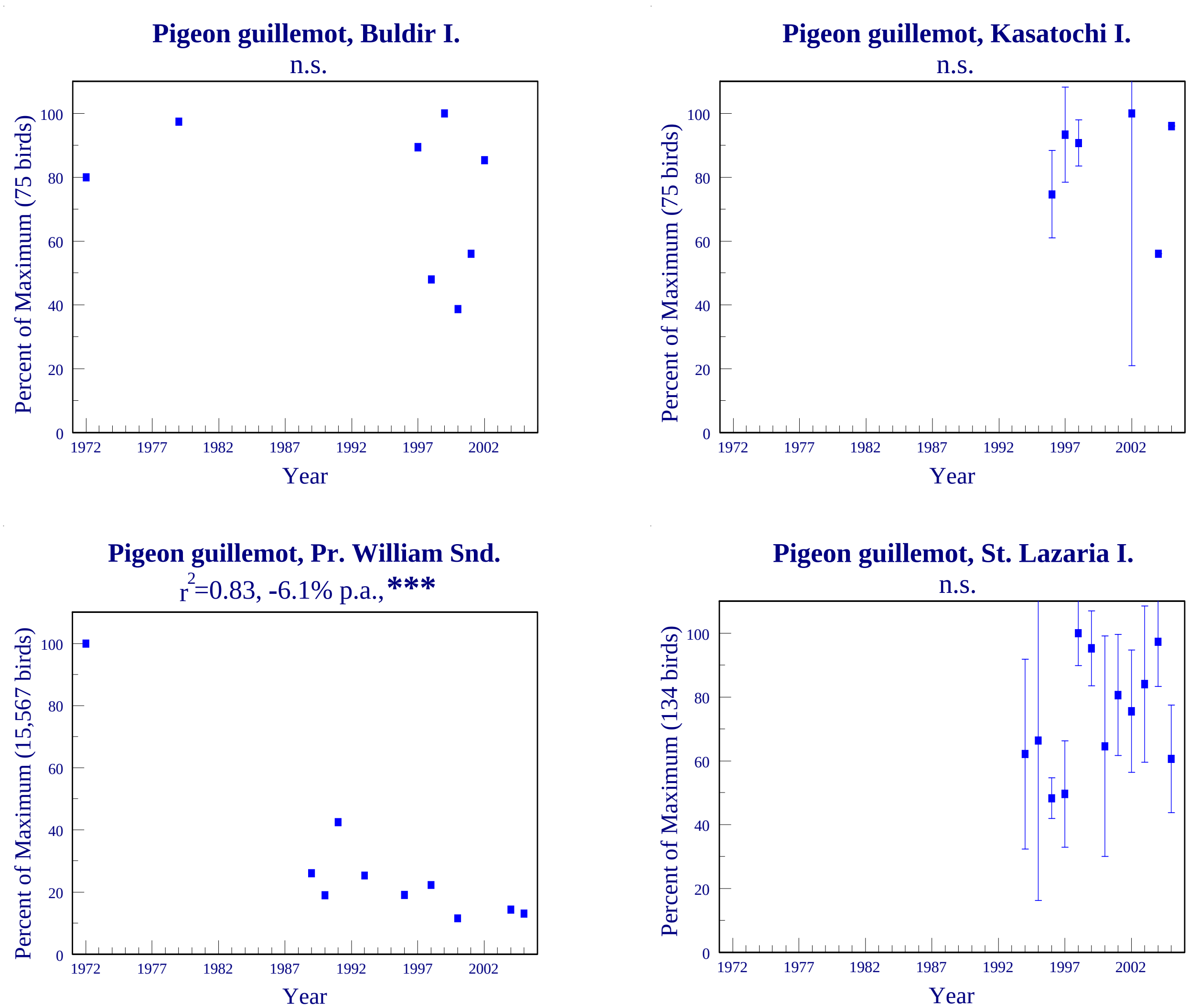


Figure 33. Trends in populations of pigeon guillemots at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

Diet.–Diets collected from a small sample of birds from Aiktak Island included walleye pollock, greenling, unidentified fish, and invertebrates (Fig. 34). Identified bill loads from Prince William Sound consisted almost entirely of fish; the predominant taxa were smelt, gunnel, and gadid.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

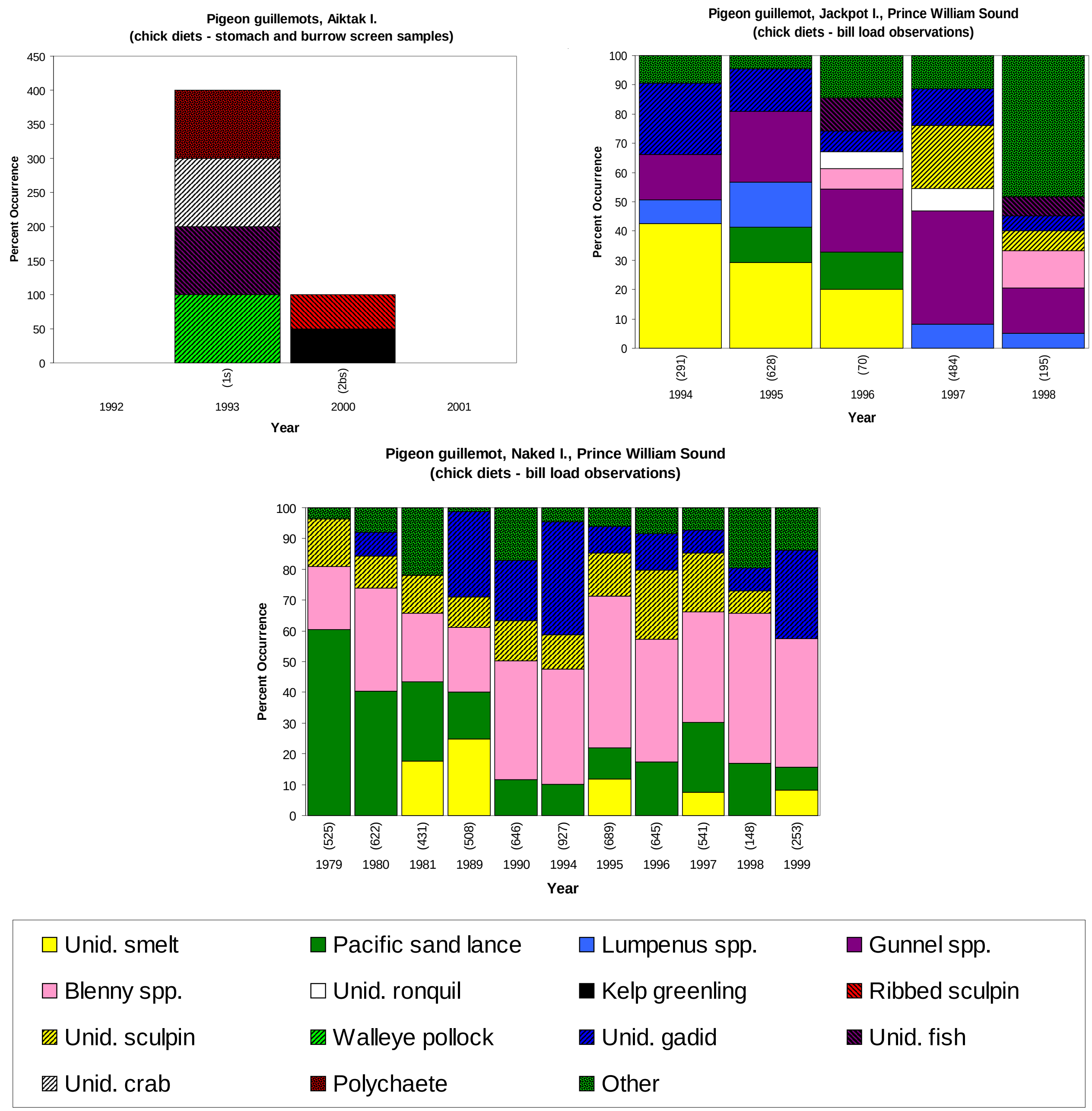


Figure 34. Diets of pigeon guillemots at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar. Because Prince William Sound samples were reported as bill load observations, and because each bird carries only one fish per observation, the total percent occurrence for each year was 100%.

Ancient murrelet (*Synthliboramphus antiquus*)

Breeding chronology.–The mean hatching date for ancient murrelets was earlier than average at Aiktak Island, the only site where this species was monitored in 2005 (Table 20).

Table 20. Hatching chronology of ancient murrelets at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Aiktak I.	—	28 Jun (27)[a]	4 Jul[b] (8)[a]	Helm and Zeman 2006

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Ancient murrelet reproductive success was about average for this site in 2005 (Table 21).

Table 21. Reproductive performance of ancient murrelets at Alaskan sites monitored in 2005.

Site	Chicks Fledged/Egg[a]	No. of Plots	Long-term Average	Reference
Aiktak I.	0.73	N/A[b] (88)[c]	0.75 (8)[c]	Helm and Zeman 2006

[a]Total chicks fledged/Total eggs.
[b]Not applicable or not reported.
[c]Sample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

Populations.–No data.

Diet.–No data.

Parakeet auklet (*Aethia psittacula*)

Breeding chronology.–Parakeet auklet hatching chronology was about average at Buldir Island in 2005 (Table 22).

Table 22. Hatching chronology of parakeet auklets at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	4 Jul (10)[a]	5 Jul (10)	4 Jul[b] (13)[a]	Andersen and Barrett 2006
Chowiet I.	4 Jul (12)	5 Jul (12)	N/A[c]	Helm and Zeman 2007

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.
[c]Not applicable or not reported.

Productivity.–In 2005, parakeet auklet productivity was about average at Buldir Island and above average at Chowiet Island (Table 23).

Table 23. Reproductive performance of parakeet auklets at Alaskan sites monitored in 2005.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	Long-term Average	Reference
Buldir I.	0.47	N/A[b] (36)[c]	0.46 (13)[c]	Andersen and Barrett 2006
Chowiet I.	0.42	N/A (31)	0.13 (2)	Helm and Zeman 2007

[a]Nest site is defined as a site where an egg was laid.
[b]Not applicable or not reported.
[c]Sample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

Populations.–No data.

Diet.–In most years, parakeet auklets at Buldir Island primarily ate the copepod *Neocalanus cristatus*, although this prey item was relatively rare after 2000 (Fig. 35). Euphausiids were also an important prey type. In a single sample from Kasatochi Island, diet consisted entirely of *Neocalanus cristatus*.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

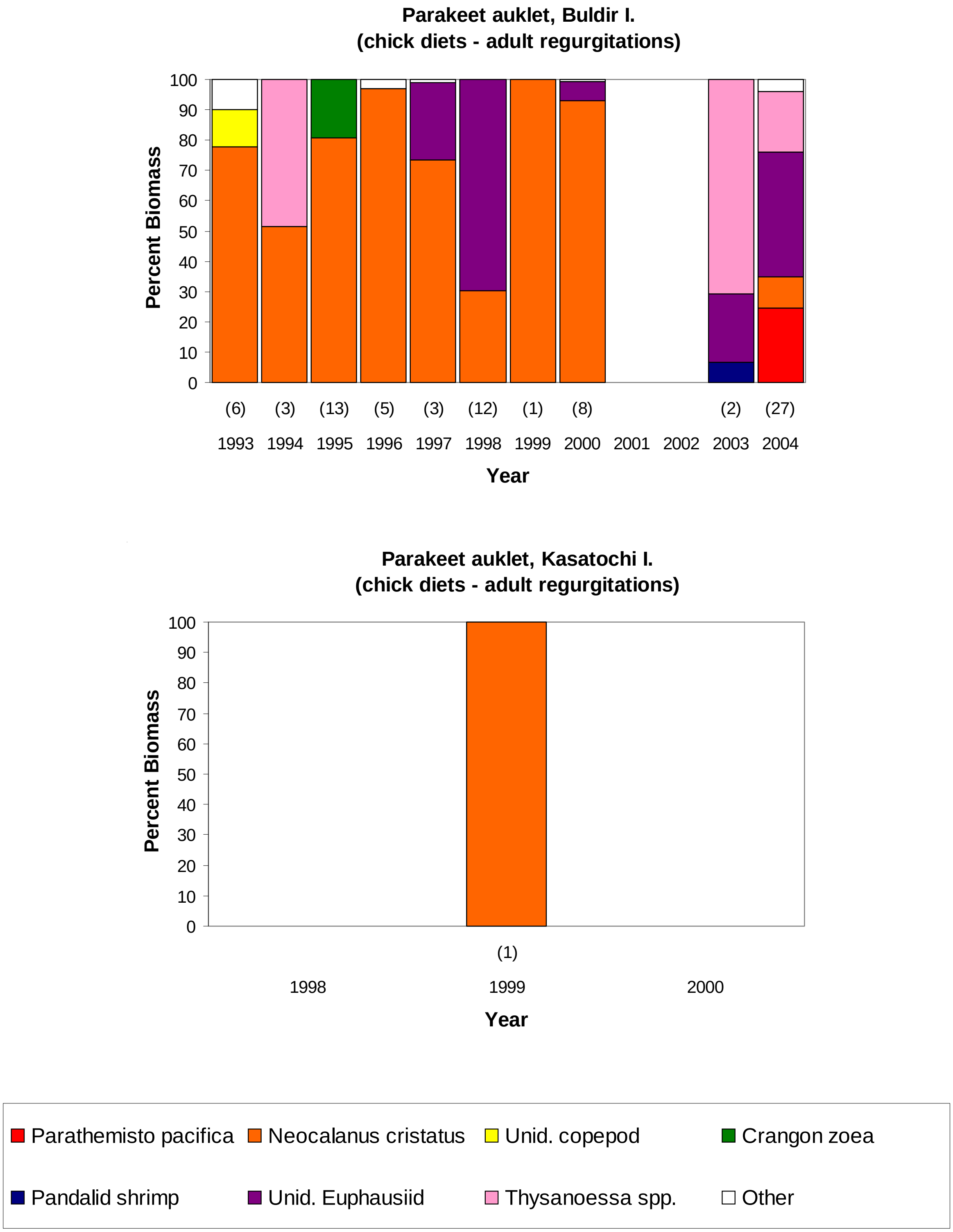


Figure 35. Diets of parakeet auklets at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent biomass of prey type in the diet. Sample sizes are reported below each bar.

Least auklet (*Aethia pusilla*)

Breeding chronology.–The dates of hatching for least auklets were about average at Buldir and Kasatochi islands in 2005 (Table 24, Fig. 36).

Table 24. Hatching chronology of least auklets at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	25 Jun (33)[a]	25 Jun (33)	28 Jun[b] (15)[a]	Andersen and Barrett 2007
Kasatochi I.	29 Jun (55)	29 Jun (55)	29 Jun[b] (9)	Drummond and Rehder 2005

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Least auklets exhibited average reproductive success at Buldir Island and below average productivity at Kasatochi Island in 2005 (Table 25, Fig. 37).

Table 25. Reproductive performance of least auklets at Alaskan sites monitored in 2005.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	Long-term Average	Reference
Buldir I.	0.60	N/A[b] (73)[c]	0.52 (15)[c]	Andersen and Barrett 2006
Kasatochi I.	0.39	N/A (93)	0.58 (9)	Drummond and Rehder 2005

[a]Nest site is defined as a site where an egg was laid.
[b]Not applicable or not reported.
[c]Sample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

Populations.–No data.

Diet.–Diet samples from least auklets at St. Lawrence Island consisted of the copepods *Neocalanus plumchrus/flemengeri*, *N. cristatus* and the amphipod *Parathemisto libelulla* (Fig. 38). Least auklets at St. Paul Island showed a great deal of yearly variation in diet; *Neocalanus plumchrus/flemengeri* dominated in some years, the copepod *Calanus marshallae* and euphausiids dominated in others. Diet samples from St. George Island consisted primarily of copepods. Euphausiids were also an important prey item there. Least auklets at Buldir, Kiska, Kasatochi, Gareloi, and the Semidi islands ate mostly copepods, primarily *Neocalanus plumchrus/flemengeri* in most years.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the “other” category.

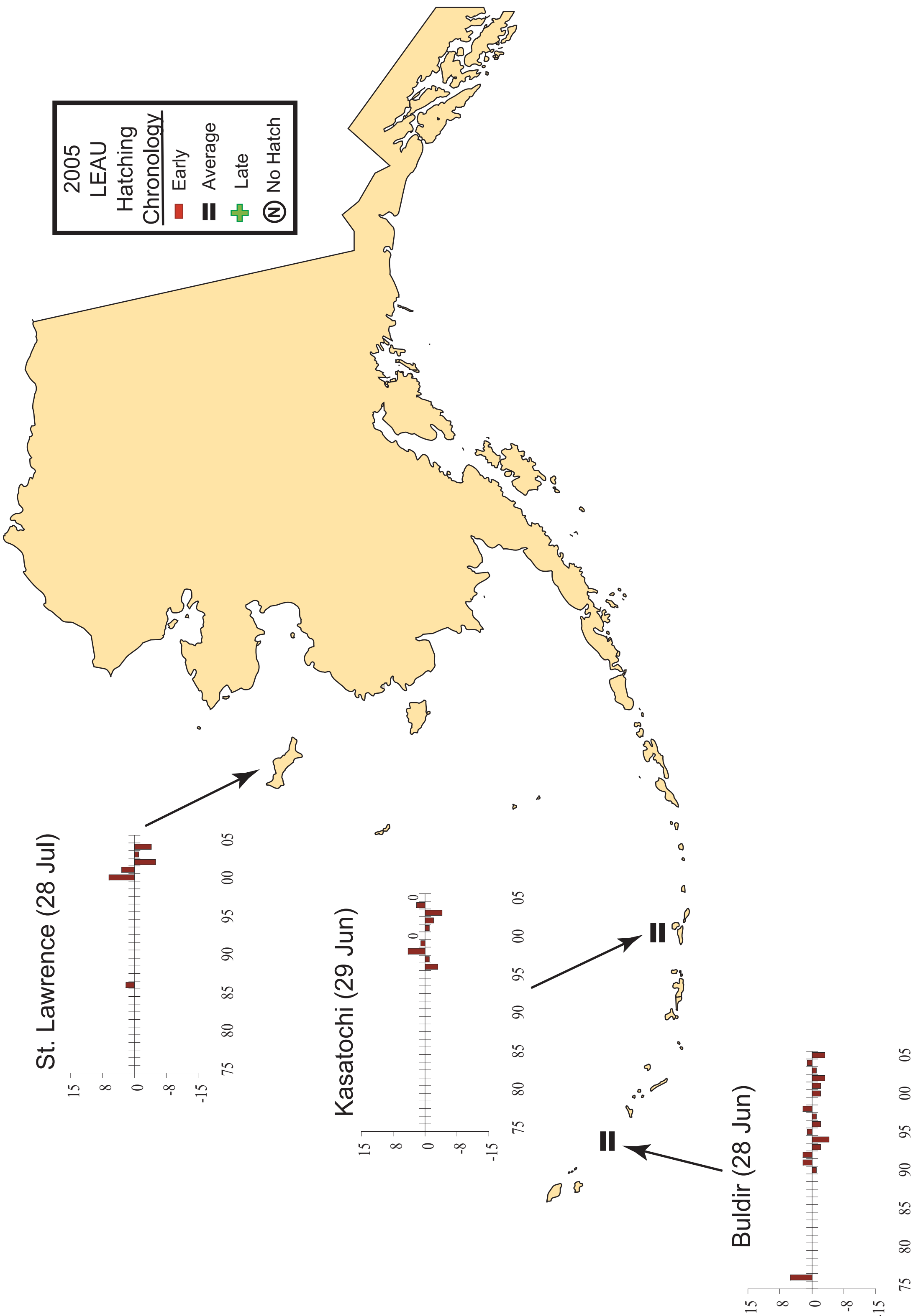


Figure 36. Hatching chronology of least auklets at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

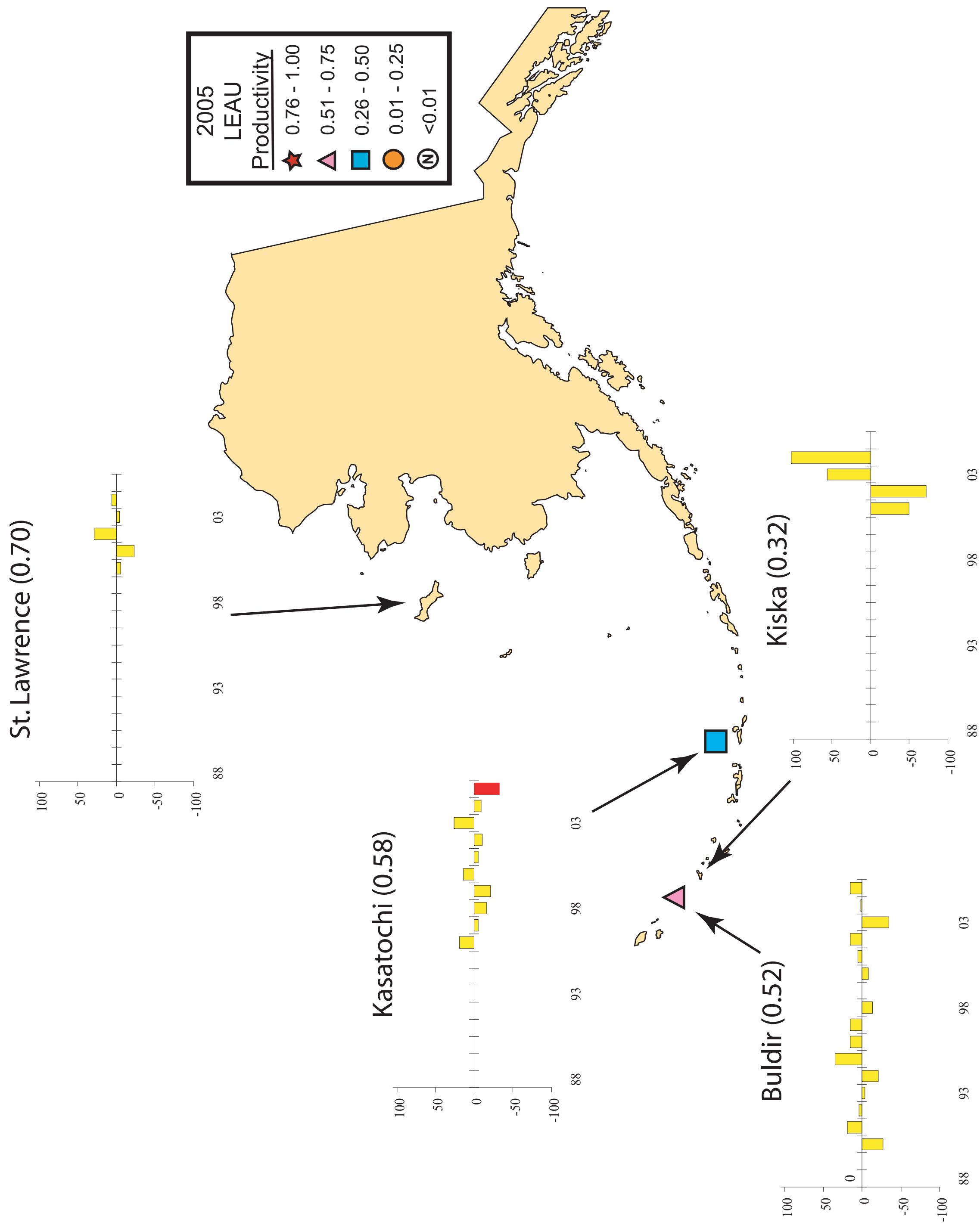


Figure 37. Productivity of least auklets (chicks fledged/nest site) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

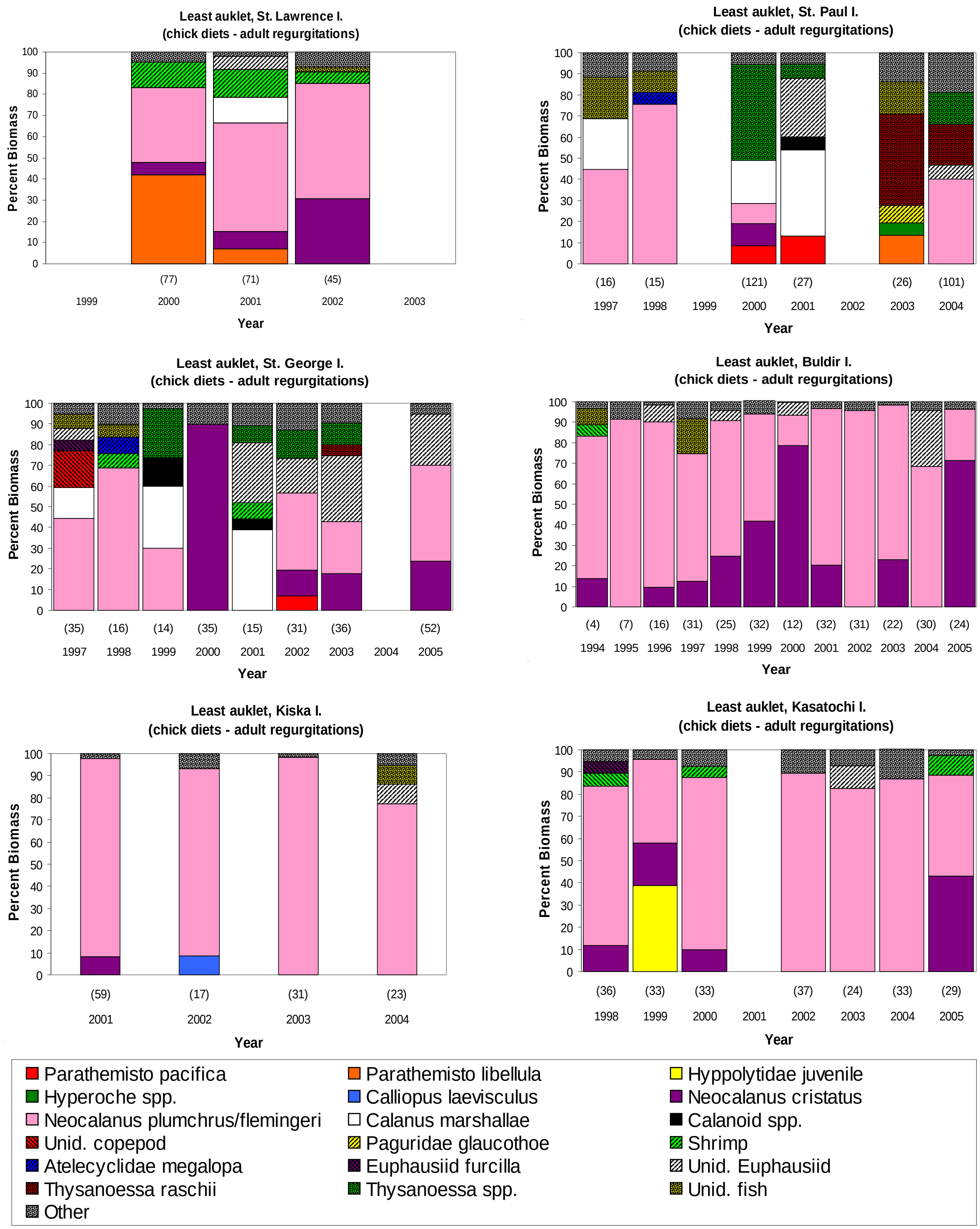


Figure 38. Diets of least auklets at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent biomass of prey type in the diet. Sample sizes are reported below each bar.

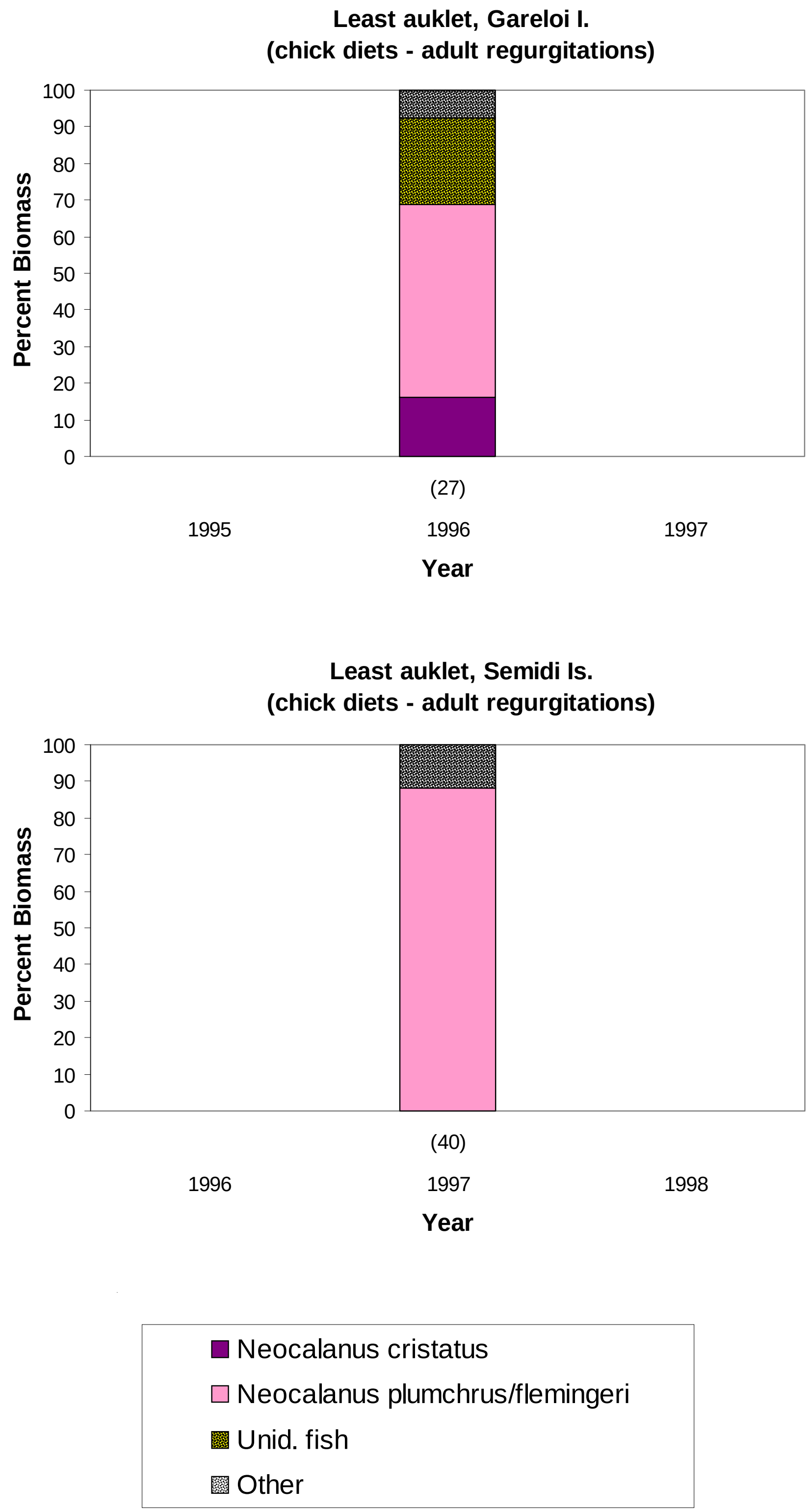


Figure 38 (continued). Diets of least auklets at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent biomass of prey type in the diet. Sample sizes are reported below each bar.

Whiskered auklet (*Aethia pygmaea*)

Breeding chronology.–The mean hatching date for whiskered auklets was earlier than average at Buldir Island, the only site where this species was monitored in 2005 (Table 26).

Table 26. Hatching chronology of whiskered auklets at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	16 Jun (29)[a]	18 Jun (29)	23 Jun[b] (15)[a]	Andersen and Barrett 2006

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means

Productivity.–Productivity of whiskered auklets at Buldir Island was above average for this species at the only site at which it was monitored in 2005 (Table 27).

Table 27. Reproductive performance of whiskered auklets at Alaskan sites monitored in 2005.

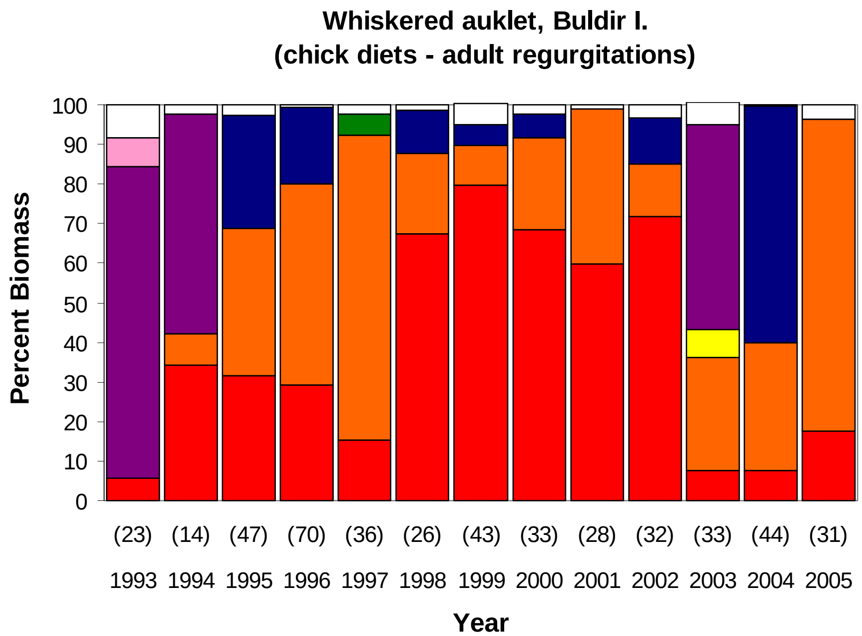
Site	Chicks Fledged/ Nest Site[a]	No. of Plots	Long-term Average	Reference
Buldir I.	0.76	N/A[b] (70)[c]	0.57 (14)[c]	Andersen and Barrett 2006

[a]Nest site is defined as a site where an egg was laid.
[b]Not applicable or not reported.
[c]Sample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

Populations.–No data.

Diet.–Diet samples from whiskered auklets at Buldir Island were dominated in most years by the copepods *Neocalanus cristatus* and *Neocalanus plumchrus/flemengeri*, although in several years euphausiids were the dominant prey type. Least auklets at Egg Island, in the Fox Island group, ate predominately *Neocalanus plumchrus/flemengeri* (Fig 39).

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the “other” category.



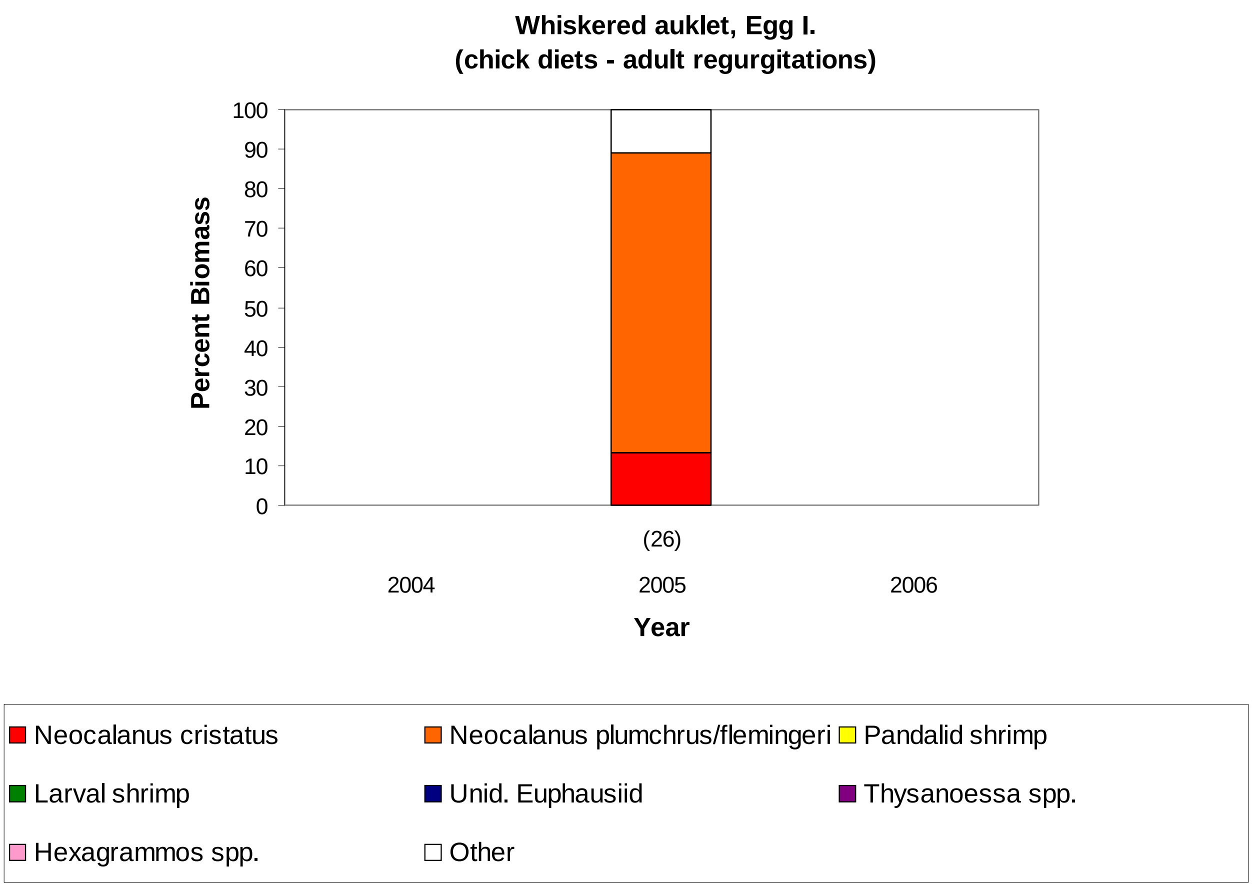
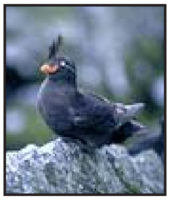


Figure 39. Diets of whiskered auklets at Buldir Island. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent biomass of prey type in the diet. Sample sizes are reported below each bar.



Crested auklet (*Aethia cristatella*)

Breeding chronology.–The mean date of hatching for crested auklets in 2005 was early at Buldir Island and about average at Kasatochi Island (Table 28, Fig. 40).

Table 28. Hatching chronology of crested auklets at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	25 Jun (29)[a]	25 Jun (29)	29 Jun[b] (15)[a]	Andersen and Barrett 2006
Kasatochi I.	29 Jun (63)	29 Jun (63)	1 Jul[b] (9)	Drummond and Rehder 2005

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Crested auklets exhibited above average productivity at Buldir Island and average success at Kasatochi Island in 2005 (Table 29, Fig. 41).

Table 29. Reproductive performance of crested auklets at Alaskan sites monitored in 2005.

Site	Chicks Fledged/ Nest Site[a]	No. of Plots	Long-term Average	Reference
Buldir I.	0.79	N/A[b] (79)[c]	0.60 (15)[c]	Andersen and Barrett 2006
Kasatochi I.	0.61	N/A (103)	0.64 (9)	Drummond and Rehder 2005

[a]Nest site is defined as a site where an egg was laid.
[b]Not applicable or not reported.
[c]Sample size in parentheses represents the number of nest sites used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

Populations.–No data.

Diet.–Diet samples from crested auklets at St. Lawrence Island consisted primarily of the euphausiid genus *Thysanoessa* (primarily *T. rashii*, Fig. 42). Crested auklets from Buldir ate predominately the copepod *Neocalanus cristatus* and euphausiids, but in 1997 larval shrimp were the dominant prey type. Diets at Kiska Island consisted mainly of euphausiids. Samples from Kasatochi Island were dominated by *Neocalanus cristatus* and euphausiids.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the “other” category.

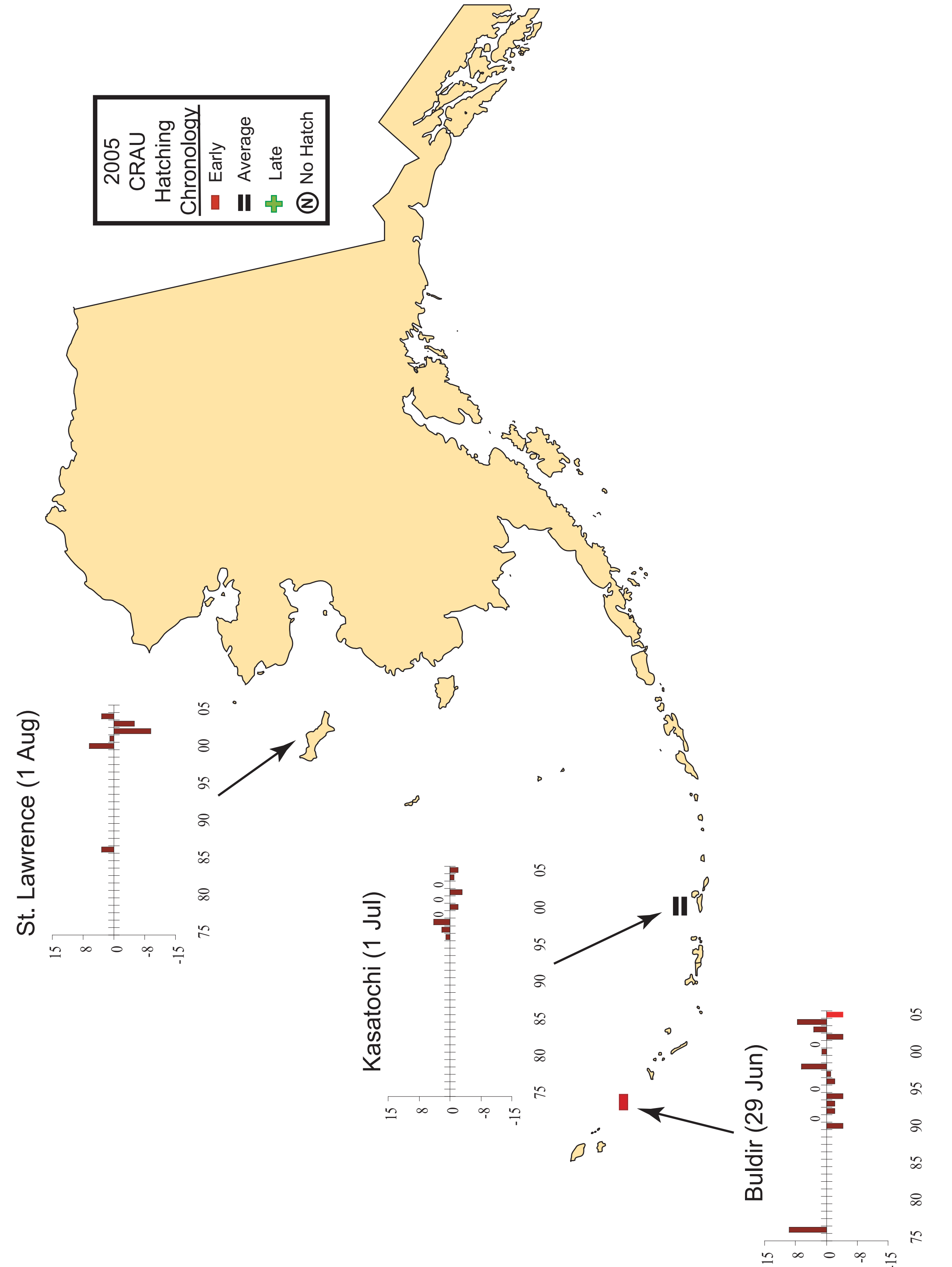


Figure 40. Hatching chronology of crested auklets at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

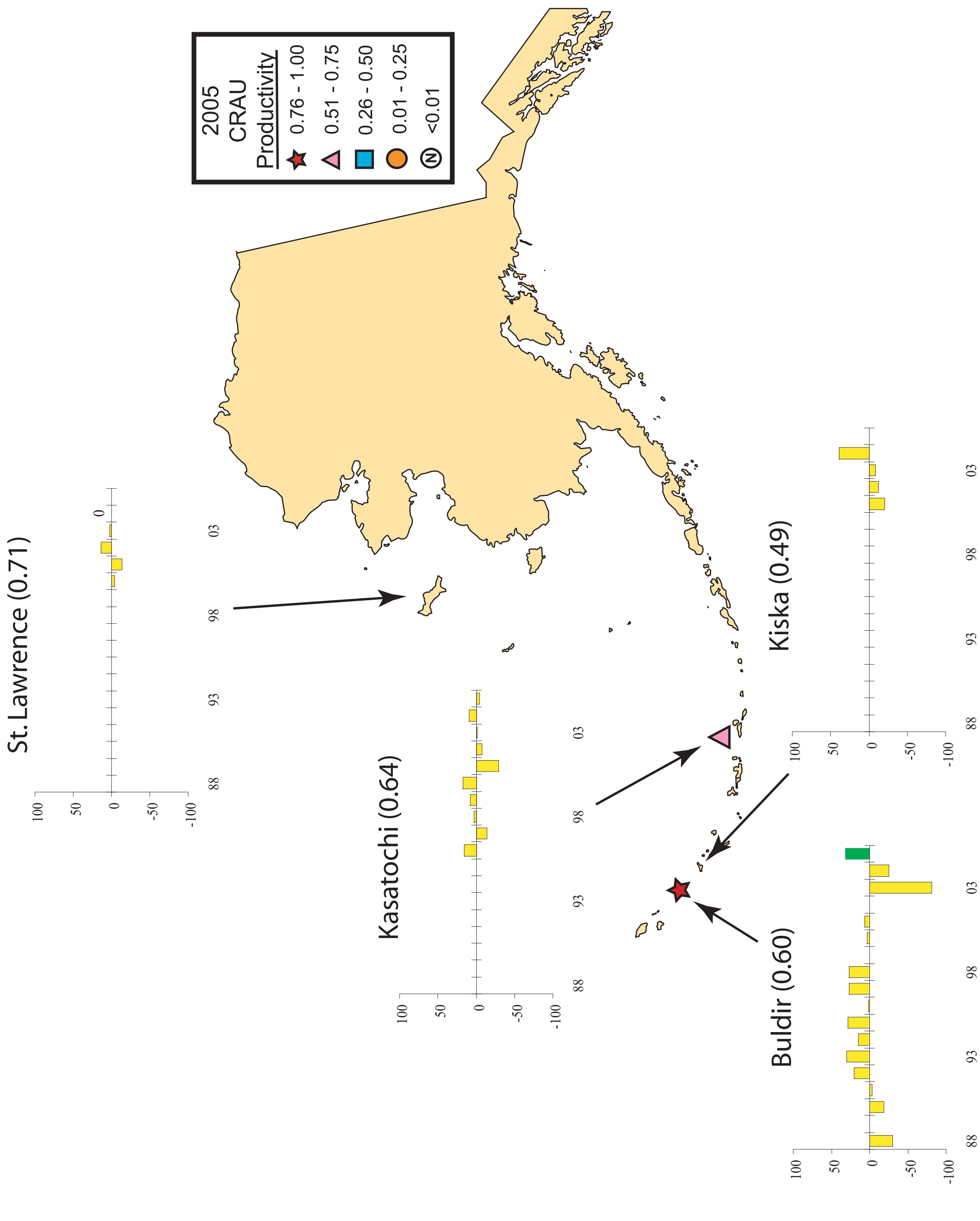


Figure 41. Productivity of crested auklets (chicks fledged/nest site) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

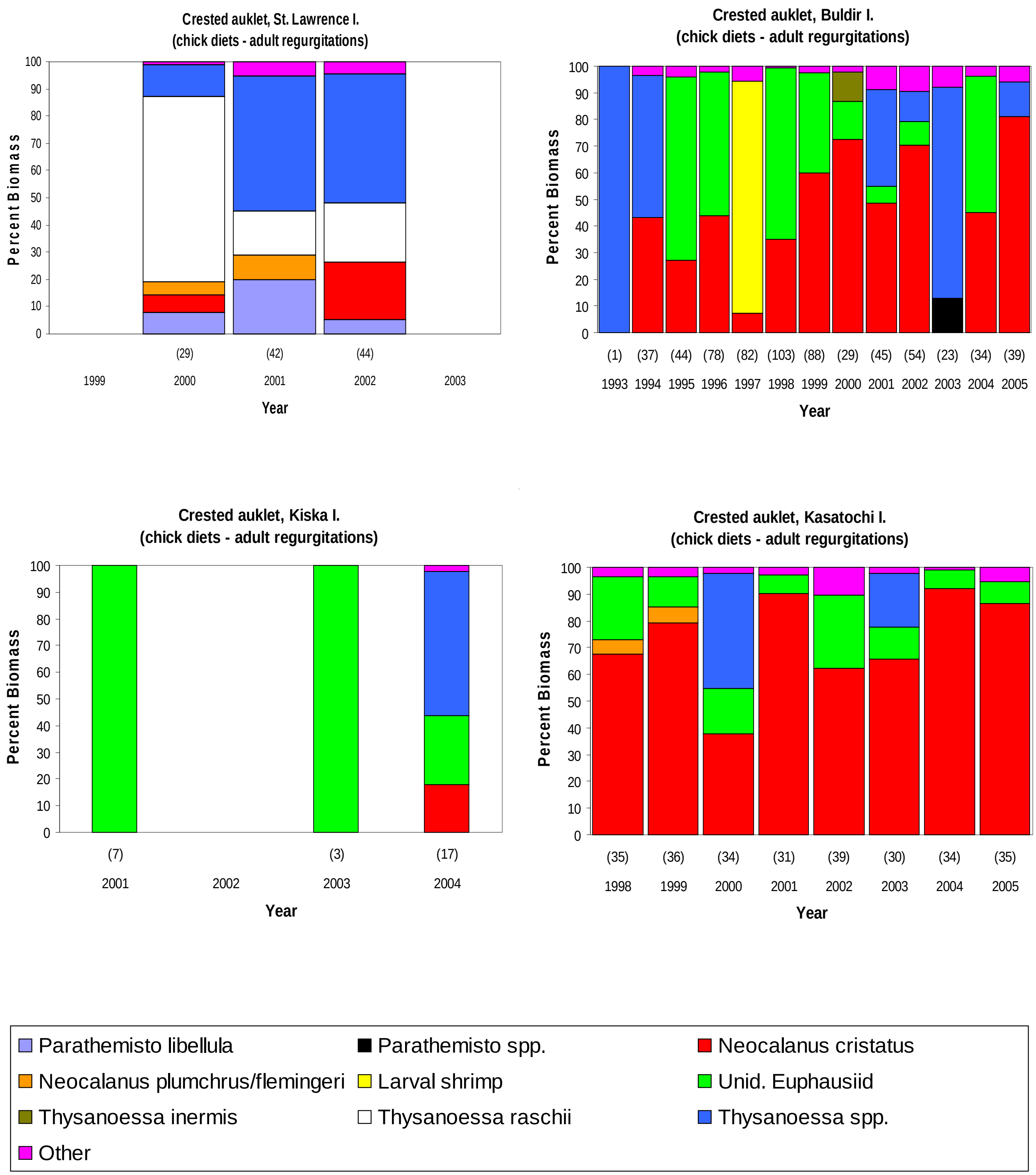


Figure 42. Diets of crested auklets at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent biomass of prey type in the diet. Sample sizes are reported below each bar.

Rhinoceros auklet (*Cerorhinca monocerata*)

Breeding chronology.–Mean hatch date for rhinoceros auklets was earlier than average at St. Lazaria Island in 2005 (Table 30).

Table 30. Hatching chronology of rhinoceros auklets at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
St. Lazaria I.	—	21 Jun (9)[a]	25 Jun[b] (10)[a]	L. Slater Unpubl. Data

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Productivity was about average at St. Lazaria Island in 2005 (Table 31).

Table 31. Reproductive performance of rhinoceros auklets at Alaskan sites monitored in 2005.

Site	Chicks Fledged/Egg	No. of Plots	Long-term Average	Reference
St. Lazaria I.	0.50	N/A[a] (N/A)[b]	0.44 (11)[b]	L. Slater Unpubl. Data

[a]Not applicable or not reported.
[b]Sample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

Populations.–We found a significant positive trend (+5.0% per annum) in populations of rhinoceros auklets at St. Lazaria Island (Fig. 43).

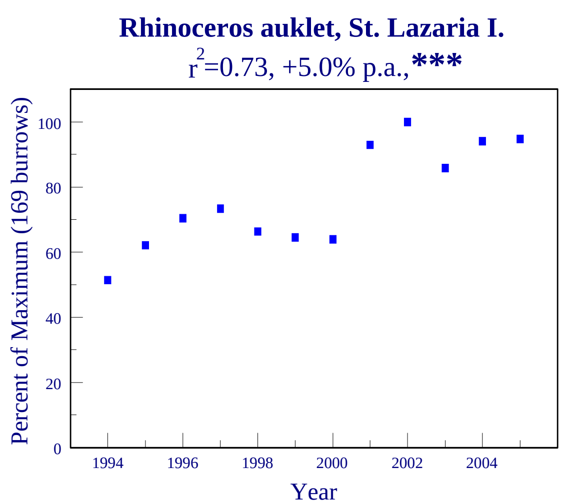


Figure 43. Trends in populations of rhinoceros auklets at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

Diet.–Diet samples from rhinoceros auklets at Chowiet and Middleton islands consisted primarily of sand lance (Fig. 44). Rhinoceros auklets from St. Lazaria Island ate primarily a combination of sand lance, capelin, and herring in most years.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

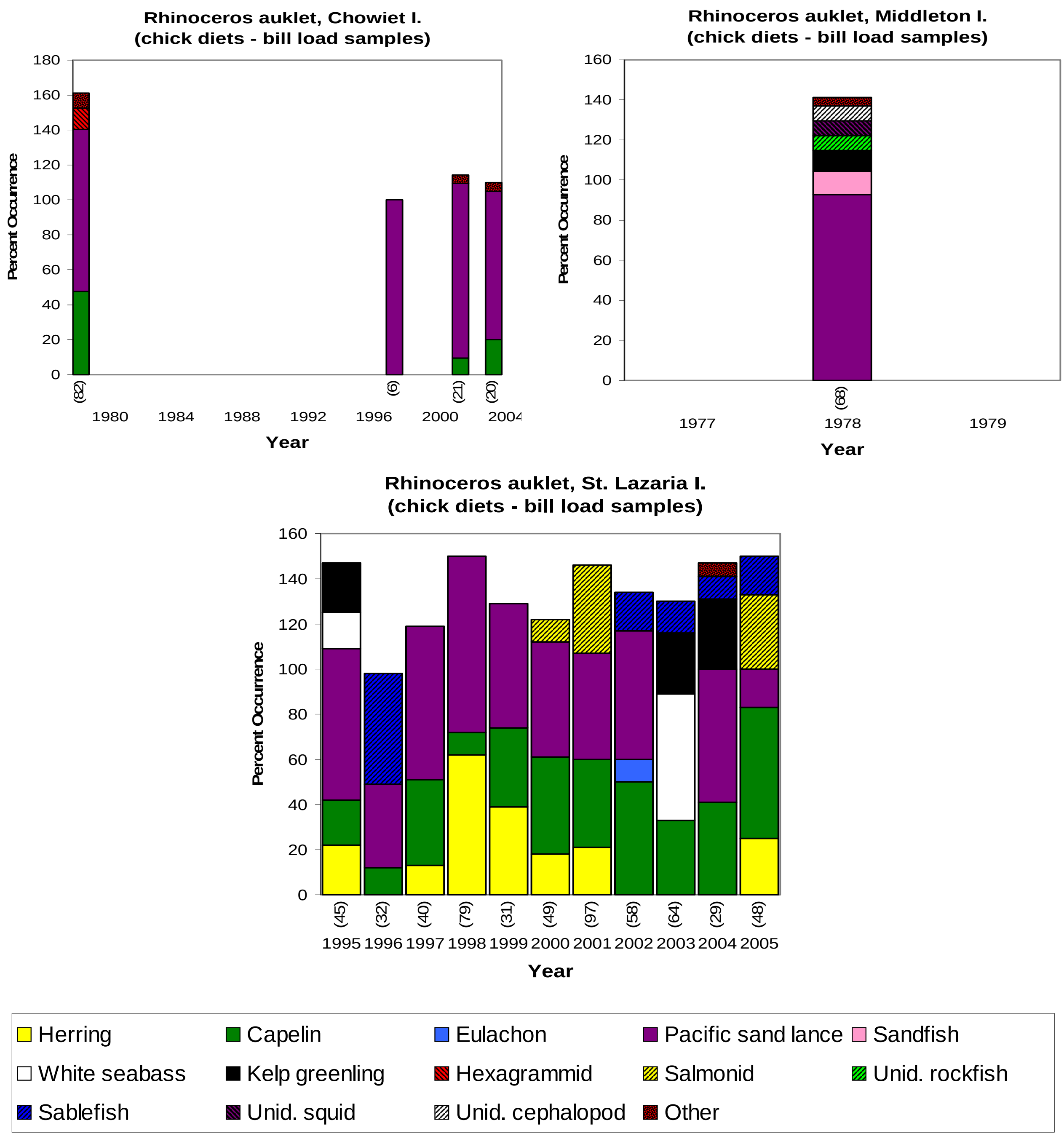
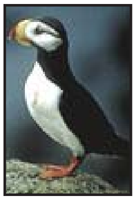


Figure 44. Diets of rhinoceros auklets at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.



Horned puffin (*Fratercula corniculata*)

Breeding chronology.–Horned puffin breeding chronology was early at Aiktak Island and about average at Buldir and Chowiet islands in 2005 (Table 32, Fig. 45).

Table 32. Hatching chronology of horned puffins at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	25 Jul (8)[a]	26 Jul (8)	23 Jul[b] (17)[a]	Andersen and Barrett 2006
Aiktak I.	27 Jul (4)	29 Jul (4)	5 Aug[b] (3)	Helm and Zeman 2006
Chowiet I.	24 Jul (37)	27 Jul (37)	29 Jul[b] (2)	Helm and Zeman 2007

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.

Productivity.–Horned puffins exhibited below average productivity at Aiktak Island and above average success at Buldir and Chowiet islands in 2005 (Table 33, Fig. 46).

Table 33. Reproductive performance of horned puffins at Alaskan sites monitored in 2005.

Site	Chicks Fledged/Egg	No. of Plots	Long-term Average	Reference
Buldir I.	0.58	N/A[a] (24)[b]	0.41 (21)[b]	Andersen and Barrett 2006
Aiktak I.	0.30	N/A (9)	0.38 (5)	Helm and Zeman 2006
Chowiet I.	0.53	N/A (47)	0.24 (2)	Helm and Zeman 2007

[a]Not applicable or not reported.
[b]Sample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

Populations.–No data.

Diet.–Diet from a small sample of horned puffins at Cape Lisburne consisted entirely of unidentified fish prey. Horned puffins at Buldir Island ate predominately Pacific sand lance, and kelp and rock greenling. A small sample from Aiktak Island showed that pollock and sand lance were important prey items (Fig. 47).

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

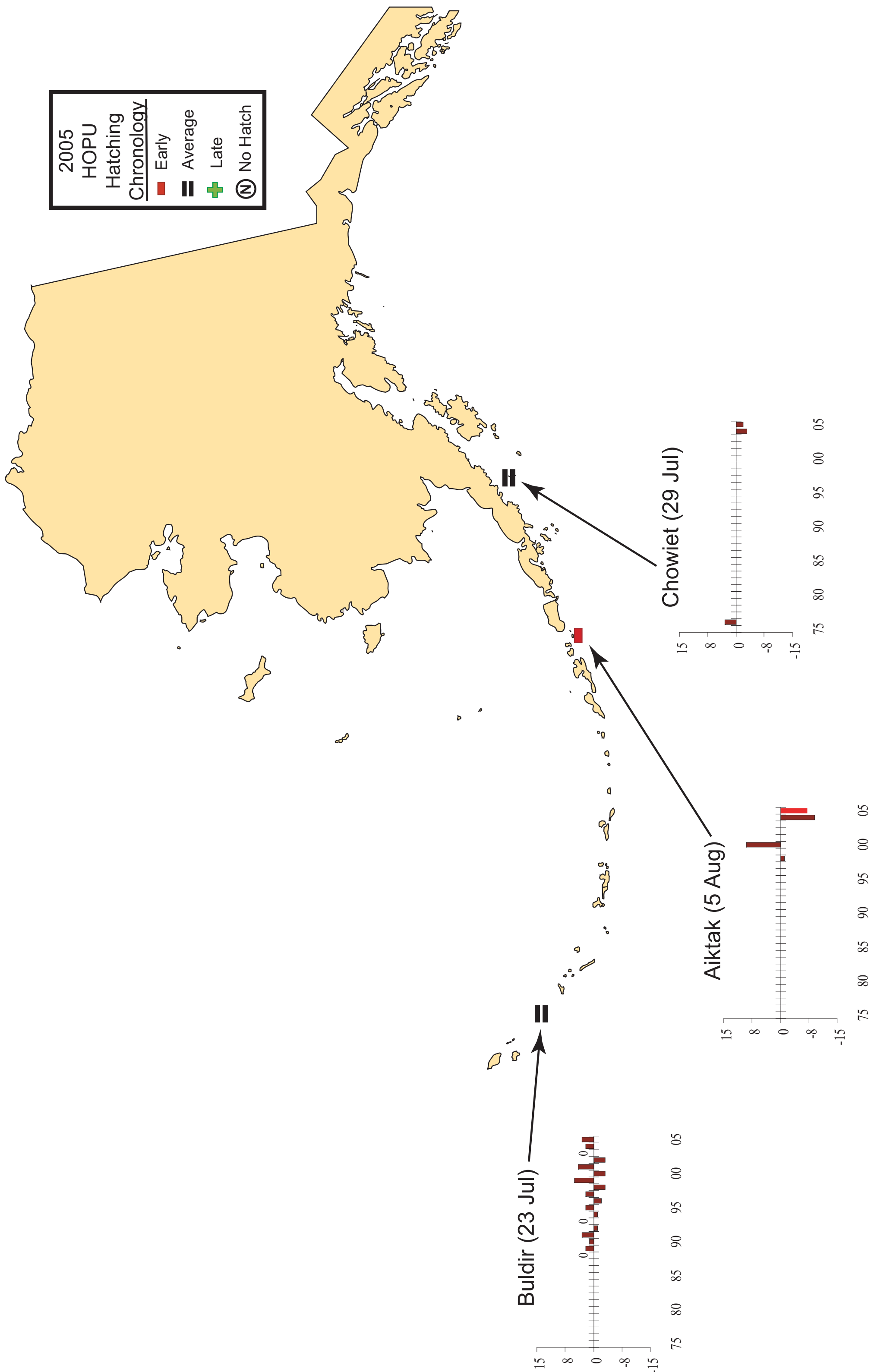


Figure 45. Hatching chronology of horned puffins at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

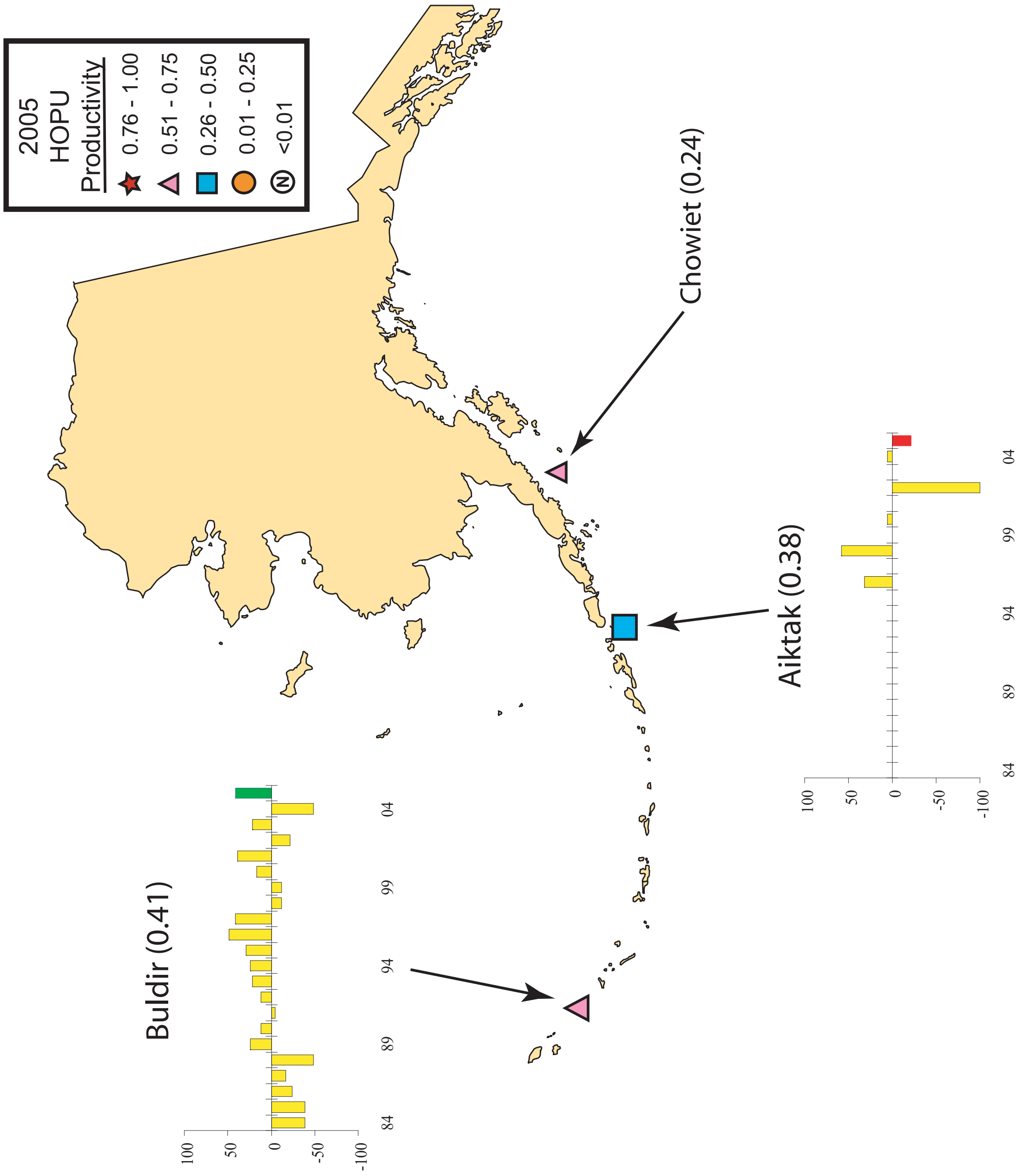


Figure 46. Productivity of horned puffins (chicks fledged/egg) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

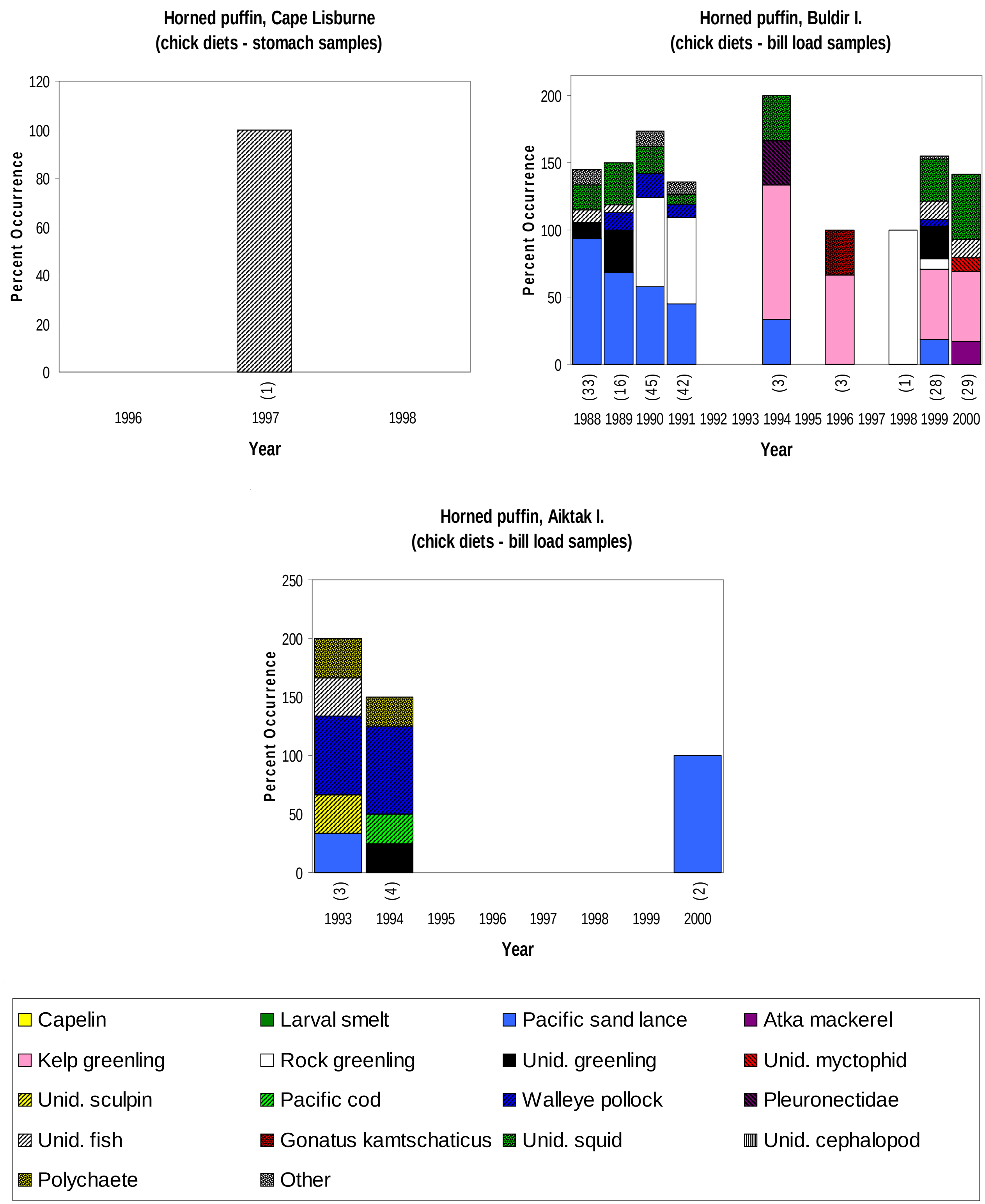


Figure 47. Diets of horned puffins at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

Tufted puffin (*Fratercula cirrhata*)

Breeding chronology.–Hatch dates for tufted puffins were later than normal at Buldir and Aiktak islands in 2005 (Table 34, Fig. 48).

Table 34. Hatching chronology of tufted puffins at Alaskan sites monitored in 2005.

Site	Median	Mean	Long-term Average	Reference
Buldir I.	25 Jul (5)[a]	25 Jul (5)	14 Jul[b] (15)[a]	Andersen and Barrett 2006
Aiktak I.	8 Aug (8)	8 Aug (8)	3 Aug[b] (8)	Helm and Zeman 2006
Chowiet I.	16 Jul (27)	17 Jul (27)	N/A[c]	Helm and Zeman 2007

[a]Sample size in parentheses represents the number of nest sites used to calculate the mean or median hatch date and the number of years used to calculate the long-term average. Current year not included in long-term average.
[b]Mean of annual means.
[c]Not applicable or not reported.

Productivity.–In 2005, tufted puffin productivity was about average at Aiktak Island and above average at Buldir Island (Table 35, Fig. 49).

Table 35. Reproductive performance of tufted puffins at Alaskan sites monitored in 2005.

Site	Chicks Fledged[a]/Egg	No. of Plots	Long-term Average	Reference
Buldir I.	0.55	N/A[b] (11)[c]	0.42 (17)[c]	Andersen and Barrett 2006
Aiktak I.	0.37	N/A (79)	0.46 (9)	Helm and Zeman 2006
Chowiet I.	0.63	N/A (41)	N/A	Helm and Zeman 2007

[a]Fledged chick defined as being still alive at last check in August or September.
[b]Not applicable or not reported.
[c]Sample size in parentheses represents the number of eggs used to calculate productivity and the number of years used to calculate the long-term average. Current year not used in long-term average.

Populations.–We found a significant positive population trend for tufted puffins at Bogoslof Island (+3.0% per annum), significant negative trends at E. Amatuli and St. Lazaria islands (-3.1% and -5.9% per annum, respectively), and no trend at Aiktak Island (Fig 50).

Diet.–Tufted puffins at Buldir and Aiktak islands ate a wide variety of prey items, including Pacific sand lance, walleye pollock, greenling and squid (Fig. 51). Diets from the Barren Islands consisted predominately of capelin and pollock. Puffins from Middleton Island consumed mostly sand lance and cephalopods.

Only prey that occurred in 5% or more of the samples in a given year are displayed in the bar for that year. Taxa appearing in <5% of the samples are grouped in the "other" category.

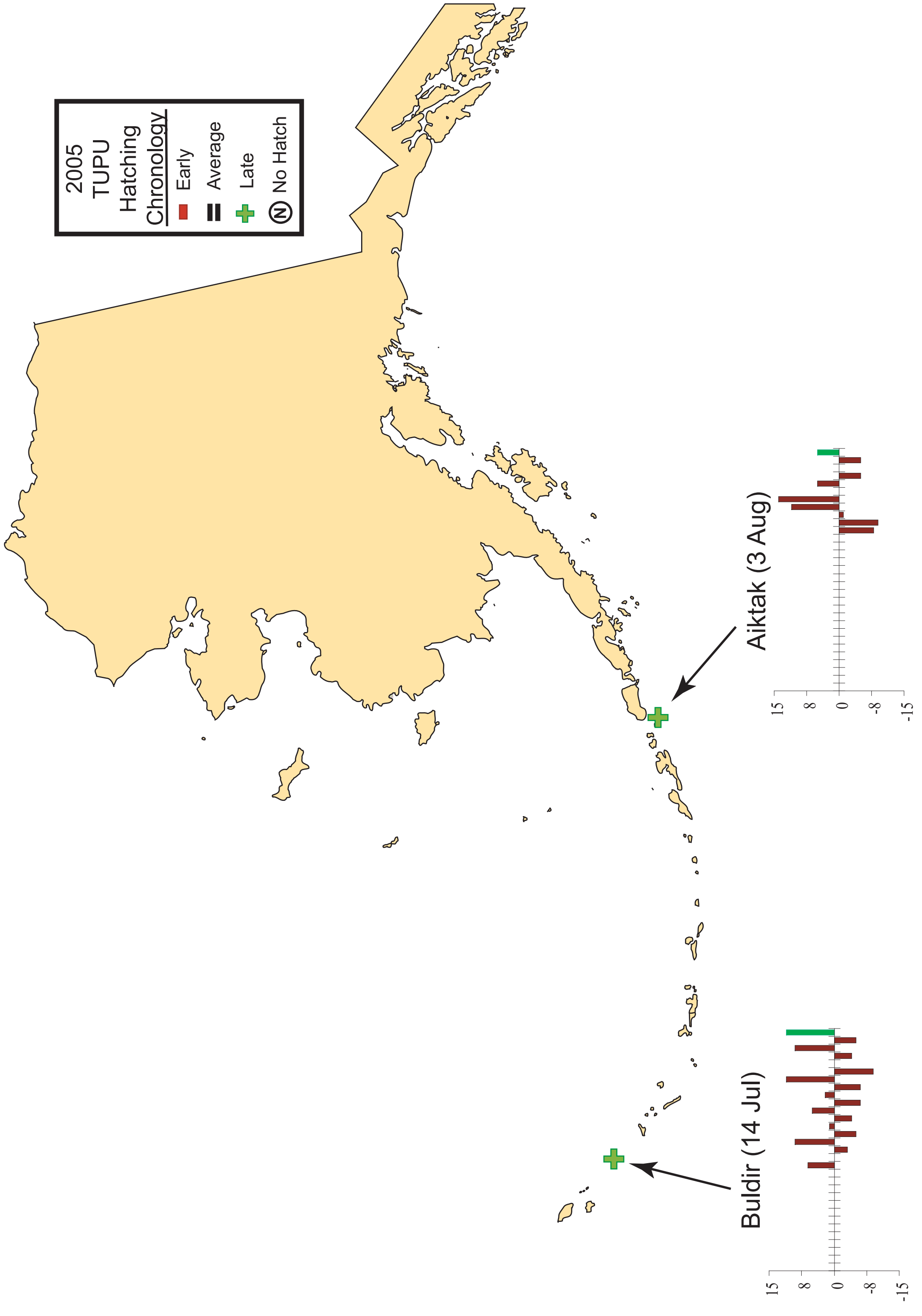


Figure 48. Hatching chronology of tufted puffins at Alaskan sites monitored in 2005. Graphs indicate the departure in days (if any), from the site mean (in parentheses; current year not included).

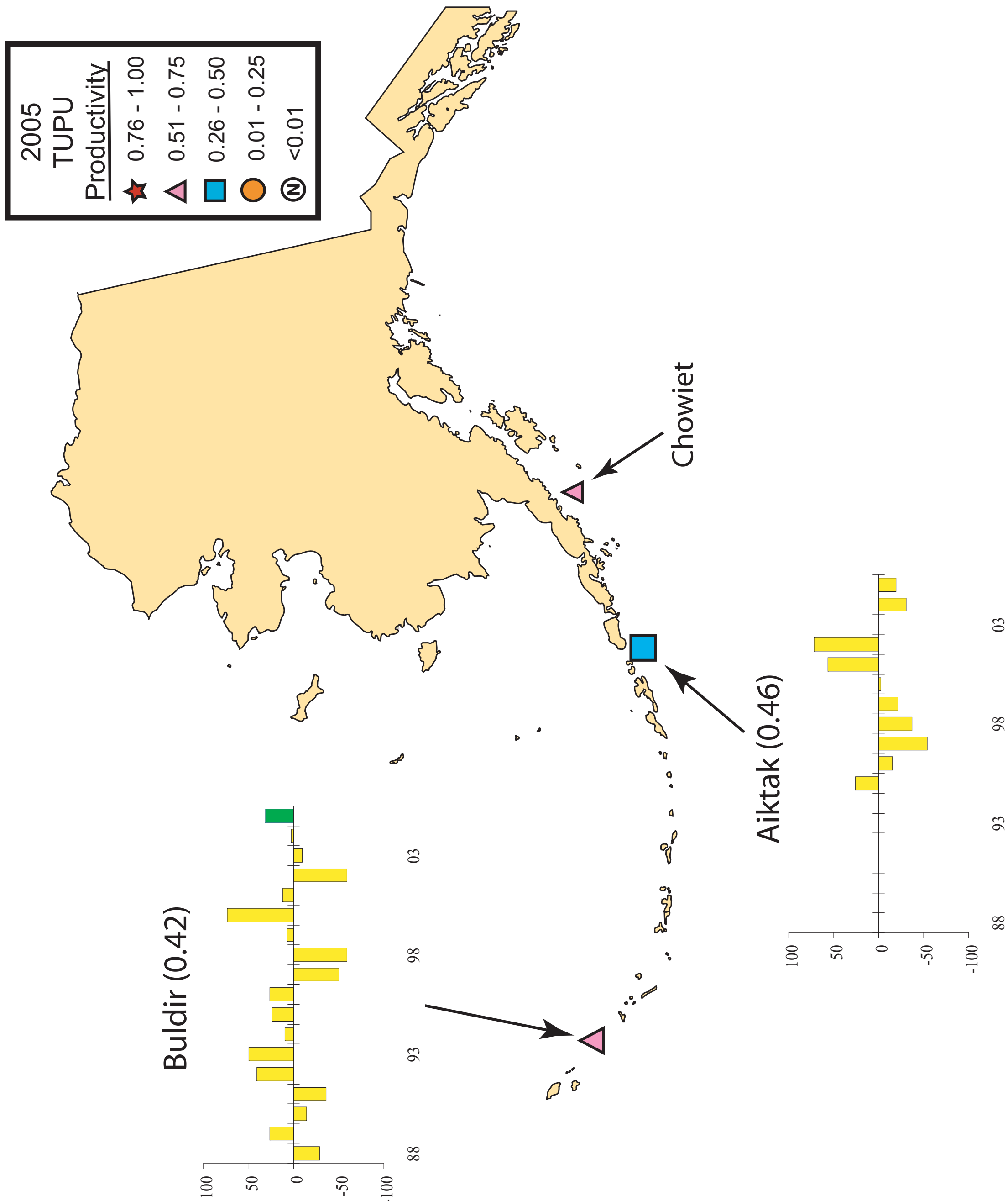


Figure 49. Productivity of tufted puffins (chicks fledged/egg) at Alaskan sites monitored in 2005. Graphs indicate the percent departure (if any) from the site mean (in parentheses; current year not included).

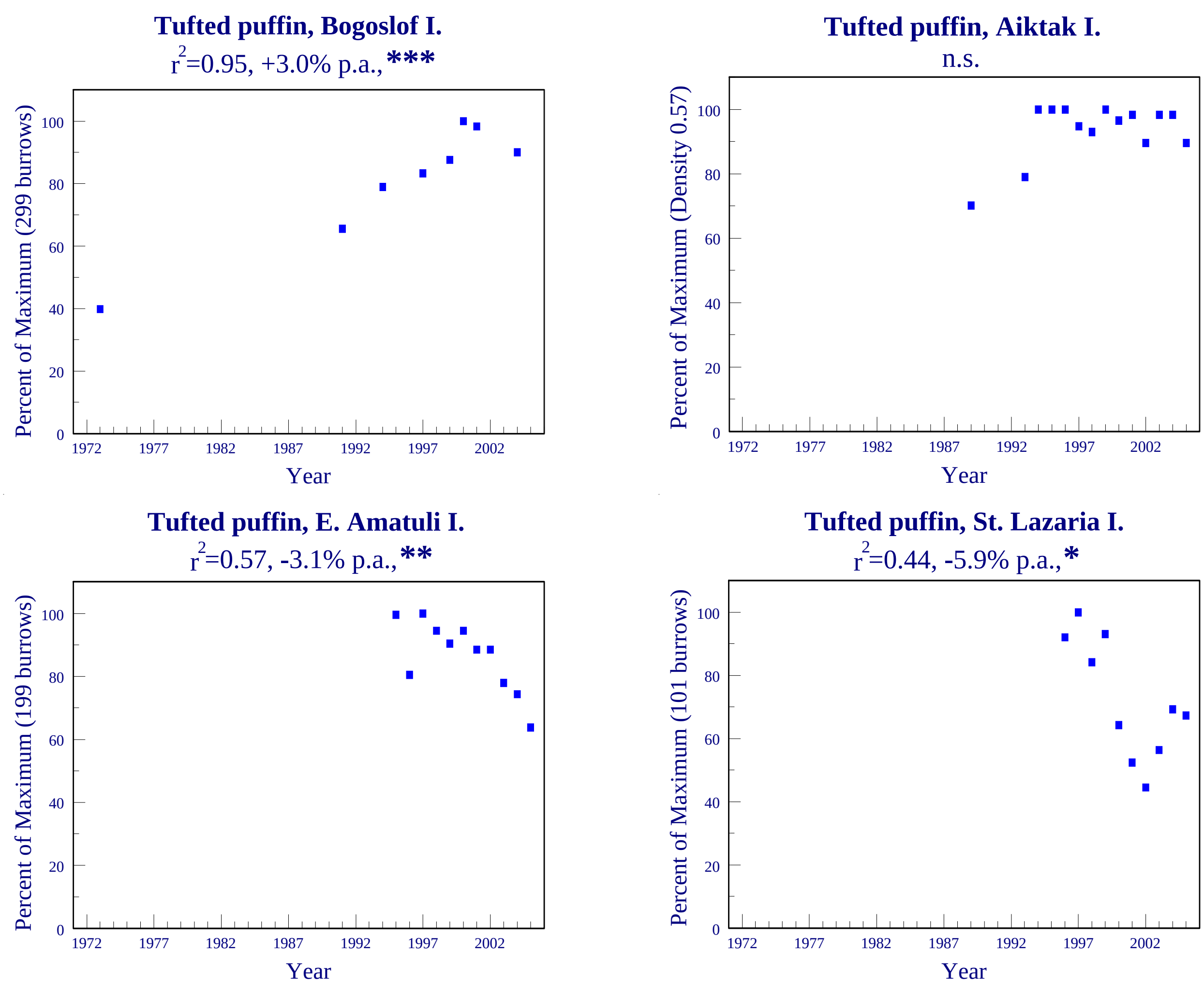


Figure 50. Trends in populations of tufted puffins at Alaskan sites. Error bars (90% confidence intervals) are shown for years with multiple counts. Significance of trends indicated as: n.s. p>= 0.05 (not significant), * p<0.05, ** p<0.01, *** p<0.001. Rates of increase or decline are reported as percent change per annum (p.a.).

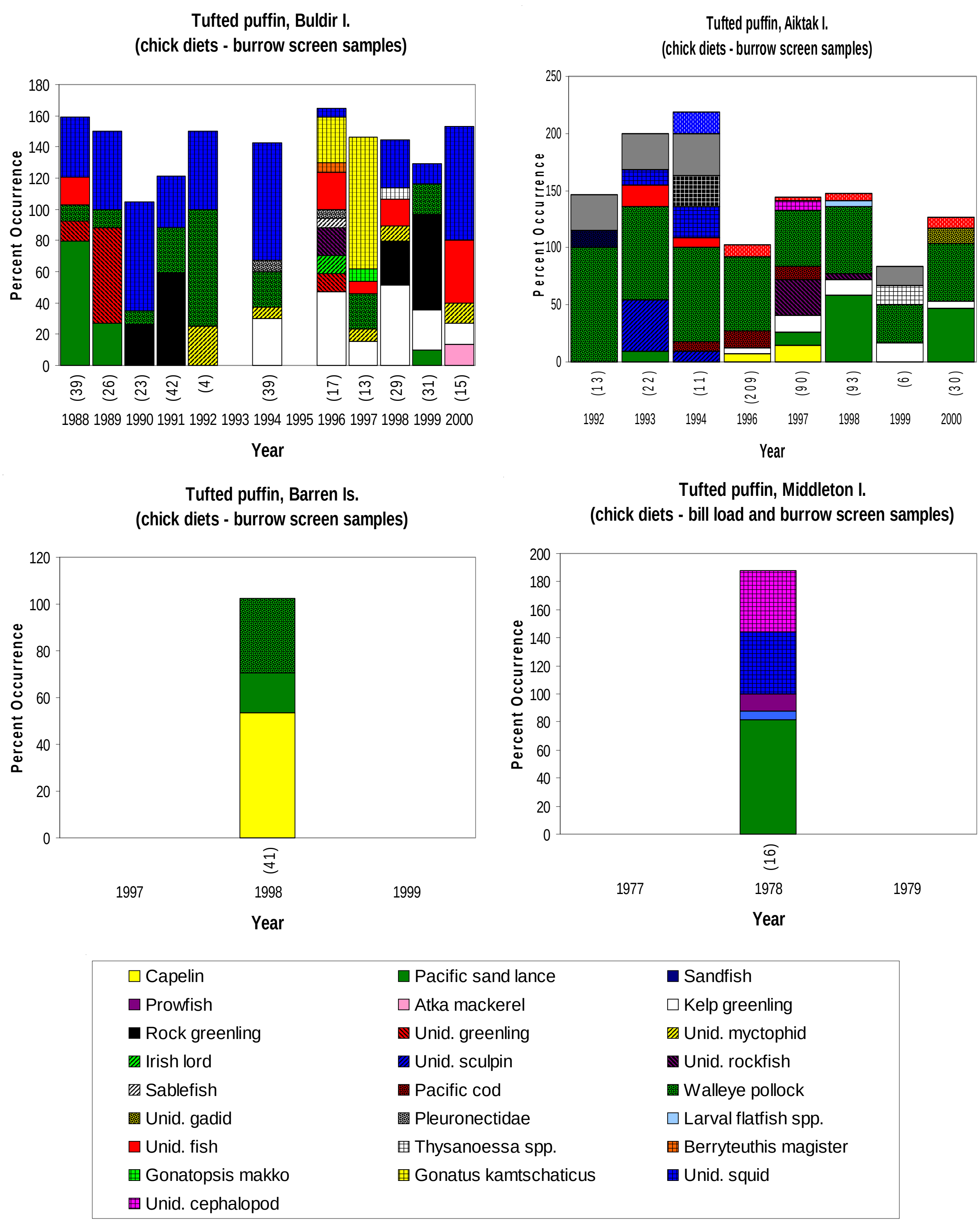


Figure 51. Diets of tufted puffins at Alaskan sites. Source of samples (adult or chick) and sample type are indicated in the graph title. Data are reported as percent occurrence of prey type in the diet. Sample sizes are reported below each bar.

Summary

Species differences

Surface plankton-feeders.–In 2005, timing of hatching was average for fork-tailed storm-petrels (FTSP) and early for Leach's storm-petrels (LHSP) at Aiktak and St. Lazaria islands (Table 36). Fork-tailed and Leach's storm-petrels had average reproductive success at all monitored sites in 2005 (Table 37). Storm-petrel (STPE) burrow densities and counts (both species combined) have increased or remained stable in recent years (Table 38).

Surface fish-feeders.–We found no significant trends for northern fulmar (NOFU) populations at Hall, St. Paul, St. George or Chowiet islands (Table 38).

Glaucous-winged gulls (GWGU) are treated here, although they are opportunistic feeders taking other birds as well as fish for prey. In 2005, gull mean hatch date was early at Aiktak Island and later than average at St. Lazaria Island (Table 36). Gulls had below average success at Aiktak Island, and average reproduction at Buldir, Chowiet and St. Lazaria islands in 2005 (Table 37). Gull populations showed stable trends at four colonies, a significant decline at Buldir Island and an increase at St. Lazaria Island (Table 38).

Black-legged kittiwake (BLKI) hatch dates were earlier than normal at two of seven sites, average at three colonies and later than average at two locations in 2005 (Table 36). In 2005 black-legged kittiwake productivity was below average at all but two of the nine monitored sites and average at the remainder (Table 37). Black-legged kittiwake populations exhibited stable trends at eight sites, significant declines at four colonies and significant positive trends at two locations (Table 38).

Red-legged kittiwake (RLKI) hatching chronology was average at St. George Island and later than average at Buldir Island in 2005 (Table 36). No red-legged kittiwake eggs hatched on monitored plots in 2005 at St. Paul Island. Reproductive success was below average at all four monitored colonies in 2005 (Table 37). This species exhibited a significant negative population trend at St. Paul Island, no trend at St. George Island and a significant increase at Buldir Island (Table 38).

Diving fish-feeders (nearshore).–Timing of hatching was about average for red-faced cormorants (RFCO) at St. Paul Island and pelagic cormorants (PECO) at Cape Peirce in 2005 (Table 36). Red-faced cormorants had about average reproductive success at St. George Island and below average productivity elsewhere in 2005 (Table 37). Pelagic cormorant success was below average at all monitored sites in 2005 (Table 37). We found a significant decline of red-faced cormorants at Chiniak Bay (Table 38). Pelagic cormorants showed no significant trends at two monitored colonies. Numbers of this species were increasing significantly at St. Lazaria Island, and declining at Hall Island and Chiniak Bay. Unspecified cormorant (UNCO) populations were stable at four of the five monitored colonies and declining at Shemya Island.

Pigeon guillemot (PIGU) numbers showed a significant decline in Prince William Sound but no trends at Buldir, Kasatochi or St. Lazaria islands (Table 38).

Table 36. Seabird relative breeding chronology compared to averages for past years within regions[a]. Only sites for which there were data from 2005 are included.

Region	Site	FTSP	LHSP	RFCO	PECO	GWGU	BLKI	RLKI	COMU	TBMU	ANMU	PAAU	LEAU	WHAU	CRAU	RHAU	HOPU	TUPU
N. Bering/ Chukchi	Bluff						–		–									
SE Bering	St. Paul I.			=			=	N	+	+								
	St. George I.						=	=	+	+								
	C. Peirce				=		–		–									
	Aiktak I.	=	–			–			N	N	–						–	+
SW Bering	Buldir I.						+	+	N	=		=	=	–	–		=	+
	Kasatochi I.												=		=			
Gulf of Alaska	Chowiet I.						+		–	–							=	
	E. Amatuli I.						=		+									
Southeast	St. Lazaria I.	=	–			+			=	=						–		

[a] Codes:
"– " indicates hatching chronology was > 3 days earlier than the average for this site or region,
"=" indicates within 3 days of average
"+" indicates hatching chronology was > 3 days later than the average for this site or region.
"N" indicates either that no eggs hatched or that the sample size was not adequate to make comparisons.

Table 37. Seabird relative productivity levels compared to averages for past years within regions[a]. Only sites for which there were data from 2005 are included.

Region	Site	FTSP	LHSP	RFCO	PECO	GWGU	BLKI	RLKI	COMU	TBMU	ANMU	PAAU	LEAU	WHAU	CRAU	RHAU	HOPU	TUPU
N. Bering/ Chukchi	C. Lisburne						–											
	Bluff						–											
SE Bering	St. Paul I.			–			–	–	–	–								
	St. George I.			=			–	–	–	–								
	C. Peirce				–		=		–									
	Bogoslof I.						=	–										
	Aiktak I.	=	=			–			–	–	=						–	=
SW Bering	Buldir I.	=	=	–	–	=	–	–	=	=		=	=	+	+		+	+
	Ulak I.	=		–	–													
	Kasatochi I.			–	–								–		=			
Gulf of Alaska	Chowiet I.					=	–		=	=		+					+	
	E. Amatuli I.						–											
Southeast	St. Lazaria I.	=	=		–	=			=	–						=		

[a] Codes:
"–" indicates productivity was > 20% below the average for this site or region,
"=" indicates within 20% of average
"+" indicates productivity was > 20% above the average for this site or region.

Table 38. Seabird population trends compared within regions[a].

Region	Site	NOFU	STPE	RFCO	PECO	UNCO	GWGU	BLKI	RLKI	COMU	TBMU	UNMU	PIGU	RHAU	TUPU
N. Bering/ Chukchi	C. Lisburne							=				+			
	St. Lawrence I.									=	=				
	Bluff							=		=					
	Hall I.	=			–			–		=	=				
SE Bering	St. Paul I.	=						–	–	–	–				
	St. George I.	=						=	=	=	=				
	C. Peirce				=			–		–					
	Round I.							=		=					
	Bogoslof I.						=					=			+
	Aiktak I.		=			=	=					–			=
SW Bering	Agattu I							=				+			
	Alaid/Nizki Is.					=									
	Shemya I.					–									
	Buldir I.				=		–	+	+		+		=		
	Ulak I.					=						=			
	Kasatochi I.					=	=						=		
	Koniuji I							=				+			
Gulf of Alaska	Chowiet I.	=						–				+			
	Puale Bay						=	=							
	Chiniak Bay			–	–			=							
	E. Amatuli I.		=												–
	P. William Snd							+					–		
Southeast	St. Lazaria I.		+		+		+					–	=	+	–

[a]Codes:
"– " indicates a significant (p<0.05) negative population trend for this site or region,
"=" indicates no significant trend(p>=0.05)
"+" indicates a significant (p<0.05) positive population trend for this site or region.

Diving fish-feeders (offshore).–Timing of common murre (COMU) hatching in 2005 was early at three sites, average at one colony and late at three sites (Table 36). No common murre eggs were laid on plots at Aiktak Island in 2005. The 2005 sample size of hatching dates at Buldir Island was inadequate to make comparisons for this species there. Thick-billed murre (TBMU) chronology was earlier than average at Chowiet Island, average at Buldir and St. Lazaria islands, and late at St. Paul and St. George islands in 2005 (Table 36). No thick-billed murre eggs were laid on plots at Aiktak Island in 2005.

Common and thick-billed murres exhibited average or below average reproductive success at all sites in 2005 (Table 37).

Numbers of common murres showed significant declines at two sites and remained relatively stable at five locations (Table 38). Thick-billed murre populations exhibited a significant declining trend at one site, an increase at one colony and stable numbers at three locations. At colonies where murres were not identified to species during counts (UNMU), numbers significantly increased or remained stable at six sites and showed significant negative trends at two locations (Table 38).

Ancient murrelet (ANMU) hatching chronology was early and productivity was about average at Aiktak Island in 2005 (Tables 36 and 37).

Rhinoceros auklet (RHAU) eggs hatched relatively early at St. Lazaria Island in 2005 (Table 36). This species had about average productivity at St. Lazaria Island in 2005 (Table 37). We found a significant increase in the number of rhinoceros auklet burrows at St. Lazaria Island (Table 38).

Horned puffins (HOPU) exhibited normal hatching chronology and higher than average productivity at Buldir and Chowiet islands, and early hatch dates and lower than average productivity at Aiktak Island in 2005 (Tables 36 and 37).

Tufted puffin (TUPU) eggs hatched later than the norm at Buldir and Aiktak islands in 2005 (Table 36). Reproductive success for this species was above average at Buldir Island and about average at Aiktak Island in 2005 (Table 37). Tufted puffin populations increased at one site, declined at two colonies and remained unchanged at one location (Table 38).

Diving plankton-feeders.–Parakeet (PAAU), least (LEAU), whiskered (WHAU) and crested (CRAU) auklets had approximately average nesting chronologies at most sites where they were monitored in 2005 (Table 36). With one exception, parakeet, least, whiskered and crested auklets had average or above average success at all monitored sites in 2005. Least auklet productivity was below average at Kasatochi Island (Table 37).

Regional differences

Northern Bering/Chukchi.–Black-legged kittiwakes and common murres hatched earlier than normal at Bluff in 2005 (Table 36). Reproductive success was below average for black-legged kittiwakes at Cape Lisburne and Bluff in 2005 (Table 37). We found no trends in northern fulmar numbers at Hall Island but pelagic cormorant populations there were down significantly (Table 38). Black-legged kittiwake populations also exhibited a negative trend at Hall Island but were stable at Cape Lisburne and Bluff. Neither common nor thick-billed murre populations showed a significant trend at any monitored colony in this region whereas unspecified murres increased significantly at Cape Lisburne.

Southeastern Bering.–Fork-tailed storm-petrel hatching chronology was about average, whereas Leach's storm-petrels hatched early at Aiktak Island in 2005 (Table 36). Cormorants exhibited about average hatching chronology in this region but glaucous-winged gulls and ancient murrelets were early. Kittiwake chronology was average or early in this region. Red-legged kittiwake eggs failed to hatch at St. Paul Island in 2005. Timing of murre hatching was early at Cape Peirce and late at the Pribilof Islands. Neither species of murre laid eggs on plots at Aiktak Island this year. Horned puffin eggs hatched earlier than normal and tufted puffin hatching was late at Aiktak Island in 2005.

Storm-petrel reproductive success was average in this region in 2005 (Table 37). Cormorants and glaucous-winged gulls experienced average or below average productivity. Kittiwakes exhibited lower than normal productivity in most instances in this region in 2005. Murre productivity was below average at all monitored colonies in this region in 2005. Ancient murrelets and tufted puffins exhibited average productivity at Aiktak Island while horned puffin success was below average there in 2005.

Northern fulmar numbers appeared to be stable at both monitored colonies in this region (Table 38). Storm-petrel populations exhibited no trends in the eastern Aleutians (Aiktak Island). There were no clear patterns in population trends among fish-feeders in this region: 1) neither pelagic nor unspecified cormorants showed a trend; 2) glaucous-winged gull numbers appeared to be stable at Bogoslof and Aiktak islands; 3) we found significant negative trends for black-legged kittiwakes at St. Paul Island and Cape Peirce but no trends for this species at the two other monitored sites; 4) red-legged kittiwakes exhibited a significant decline at St. Paul Island but not at St. George Island; 5) we found significant negative population trends for common murres at St. Paul Island and Cape Peirce, for thick-billed murres at St. Paul Island, and for unspecified murres at Aiktak Island. Murre numbers showed no trends at other monitored sites; 6) tufted puffin population trends were significantly positive at Bogoslof Island but no trend was evident at Aiktak Island.

Southwestern Bering.–Kittiwake hatch dates were late at Buldir Island while murre breeding chronology was about average there in 2005 (Table 36). Plankton-feeders (auklets) exhibited normal breeding chronology in this region in 2005, except that whiskered and crested auklet eggs hatched earlier than average at Buldir Island. Horned puffin chronology was about average at Buldir Island. Tufted puffins exhibited later than normal hatching chronology at that colony in 2005.

Both fork-tailed and Leach's storm-petrels exhibited about average productivity in this region in 2005 (Table 37). Cormorant success was below average or average at all of the sites monitored in this region. Glaucous-winged gull productivity was average at Buldir Island. Both black- and red-legged kittiwakes experienced below average production at Buldir Island in 2005. Common and thick-billed murre productivity was about average at Buldir Island. Auklets exhibited average or below average productivity at southwestern Bering Sea colonies monitored in 2005, with the exception of above average success for both whiskered and crested auklets at Buldir Island. Puffins had above average productivity at Buldir Island in 2005.

We found no significant trends in cormorant populations at Nizki/Alaid, Buldir, Ulak or Kasatochi islands, but cormorants declined at Shemya Island (Table 38). Glaucous-winged gulls showed a significant negative population trend at Buldir Island and no trend at Kasatochi Island. Both black- and red-legged kittiwakes increased significantly at Buldir Island but the former species exhibited no trend at Agattu or Koniuji islands. Murres were either stable or increasing in this region and pigeon guillemots exhibited no trends.

Northern Gulf of Alaska.–Breeding chronology was normal or earlier than normal for kittiwakes breeding in this region in 2005 (Table 36). Murres were early at Chowiet Island and later than average at East Amatuli Island. Horned puffin chronology was normal at Chowiet Island in 2005.

Productivity was average or below average for most species monitored in this region in 2005, the exceptions being above average success for parakeet auklets and horned puffins at Chowiet Island (Table 37).

Northern fulmars showed no trend in populations at Chowiet Island (Table 38). The same can be said for storm-petrels at East Amatuli Island. We found a significant decline of both red-faced and pelagic cormorants at Chiniak Bay. Glaucous-winged gull counts indicated no trends at Puale Bay. Black-legged kittiwake numbers were significantly down at Chowiet Island, up in Prince William Sound and exhibited no trends at the remaining colonies. We found a significant positive trend for murre populations at Chowiet Island. Pigeon guillemot populations declined in Prince William Sound and tufted puffin numbers showed a significant negative trend at East Amatuli Island.

Southeast Alaska.–Fork-tailed storm-petrels exhibited average nesting chronology and Leach's storm-petrels were early at St. Lazaria Island in 2005 (Table 36). Hatch dates were late for glaucous-winged gulls, about normal for murres and earlier than average for rhinoceros auklets.

Pelagic cormorants and thick-billed murres exhibited below average success in this region in 2005, whereas storm-petrels, glaucous-winged gulls, common murres and rhinoceros aulkets all had average productivity (Table 37).

Storm-petrel, pelagic cormorant, glaucous-winged gull and rhinoceros auklet numbers increased significantly at St. Lazaria Island (Table 38). Pigeon guillemot populations were stable but murre and tufted puffin numbers showed a significant negative trend at this colony.

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All photographs used in this report are Fish and Wildlife Service pictures except those of the fork-tailed storm-petrel, parakeet auklet, least auklet, tufted puffin and horned puffin which were taken by Ian Jones, and the ancient murrelet taken by Fiona Hunter, and used with permission. Cover art by Susan Steinacher.

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Appendix 1. Masses of prey items used to estimate biomass for planktivore diet graphs (see Figs. 35, 38, 39 and 42).

		Taxon	Mass (g)
Crustaceans			
	Amphipods		
		Anoyx spp.	0.0080
		Ansiogammarus pugetensis	0.0022
		Calliopus laevisculus	0.0022
		Calliopus spp.	0.0022
		Cyphocaris challengera	0.0022
		Erichithonius hunteri	0.0022
		Erichithonius spp.	0.0022
		Eusiridae	0.0500
		Gammaridae	0.0500
		Halirages bungei	0.0500
		Hyalidae	0.2000
		Hyperia spp.	0.0020
		Hyperoche medusarum	0.0039
		Hyperoche spp.	0.1000
		Ischyrocerus spp.	0.0022
		Lamprops spp.	0.0100
		Lysianassidae	0.0040
		Onsisimus spp.	0.0022
		Parathemisto libellula (<7mm)	0.0323
		Parathemisto libellula (>12mm)	0.1670
		Parathemisto pacifica (<4mm)	0.0037
		Parathemisto spp. (<4mm)	0.0039
		Pontogeneia spp.	0.0500
		Primno macropa	0.0030
		Talitridae	0.0022
		Unid. amphipod	0.0022
	Copepods		
		Calanoid spp.	0.0020
		Calanus marshallae	0.0013
		Calanus pacificus	0.0004
		Lophothrix frontalis	0.0020
		Neocalanus cristatus	0.0139
		Neocalanus plumchrus/flemingeri	0.0028
		Pachyptilus pacifica	0.0020
		Paraeuchaeta elongata	0.0044
		Unid. copepod	0.0075
	Euphausiids		
		Euphausia pacifica	0.0227
		Euphausiid furcilla	0.0060
		Euphausiid spp. (<7mm)	0.0060
		Euphausiid spp. (>7mm)	0.0227

Appendix 1 (continued). Masses of prey items used to estimate biomass for planktivore diet graphs (see Figs. 35, 38, 39 and 42).

		Taxon	Mass (g)
Crustaceans, cont'd			
	Euphausiids, Cont'd.	*Thysanoessa inermis (<7mm)*	0.0200
		Thysanoessa inermis (>12mm)	0.0750
		Thysanoessa longipes	0.0750
		Thysanoessa raschii (<7mm)	0.0305
		Thysanoessa raschii (>12mm)	0.0978
		Thysanoessa spp. (>12mm)	0.0790
	Decapods		
		Atelecyclidae megalopa	0.0150
		Cheiragonus megalopa	0.0150
		Crangon zoea	0.0010
		Crangonidae >12mm	0.0050
		Diastylis bidentata	0.0022
		Hippolytidae juvenile	0.0370
		Hippolytidae zoea	0.0010
		Larval shrimp (<7mm)	0.0120
		Lithodidae zoea	0.0010
		Oregoniinae	0.0010
		Paguridae glaucothoe	0.0050
		Pandalid shrimp (>12mm)	0.0487
		Unid. shrimp	0.0500
	Other Crustaceans		
		Tanaidacea	0.0500
		Unid. crustacean	0.0150
Molluscs			
	Gastropods		
		Limacina helicinia	0.0020
		Limacina spp.	0.0035
		Pterepod spp.	0.0010
		Unid. snail	0.0050
	Cephalopods		
		Gonatidae	0.0600
		Unid. cephalopod	0.0600
		Unid. squid	0.0600
	Other		
		Periostracum	0.0050
		Unid. mollusc	0.0050
Insects			
		Tipulidae	0.0001
		Insect	0.0010
Fish			
		Ammodytes hexapterus (0 yr)	2.0000
		Ammodytes hexapterus (1+ yr)	5.0000

Appendix 1 (continued). Masses of prey items used to estimate biomass for planktivore diet graphs (see Figs. 35, 38, 39 and 42).

	Taxon	Mass (g)
Fish, cont'd		
	Hexagrammos spp. (1+ yr)	11.000
	Stenobrachius leucopsarus (0 yr)	2.1000
	Stenobrachius spp. (0 yr)	2.1000
	Unid. fish larvae	0.4850
	Unid. myctophidae	2.1000
Other		
	Plastic (large)	0.0200
	Plastic (small)	0.0100